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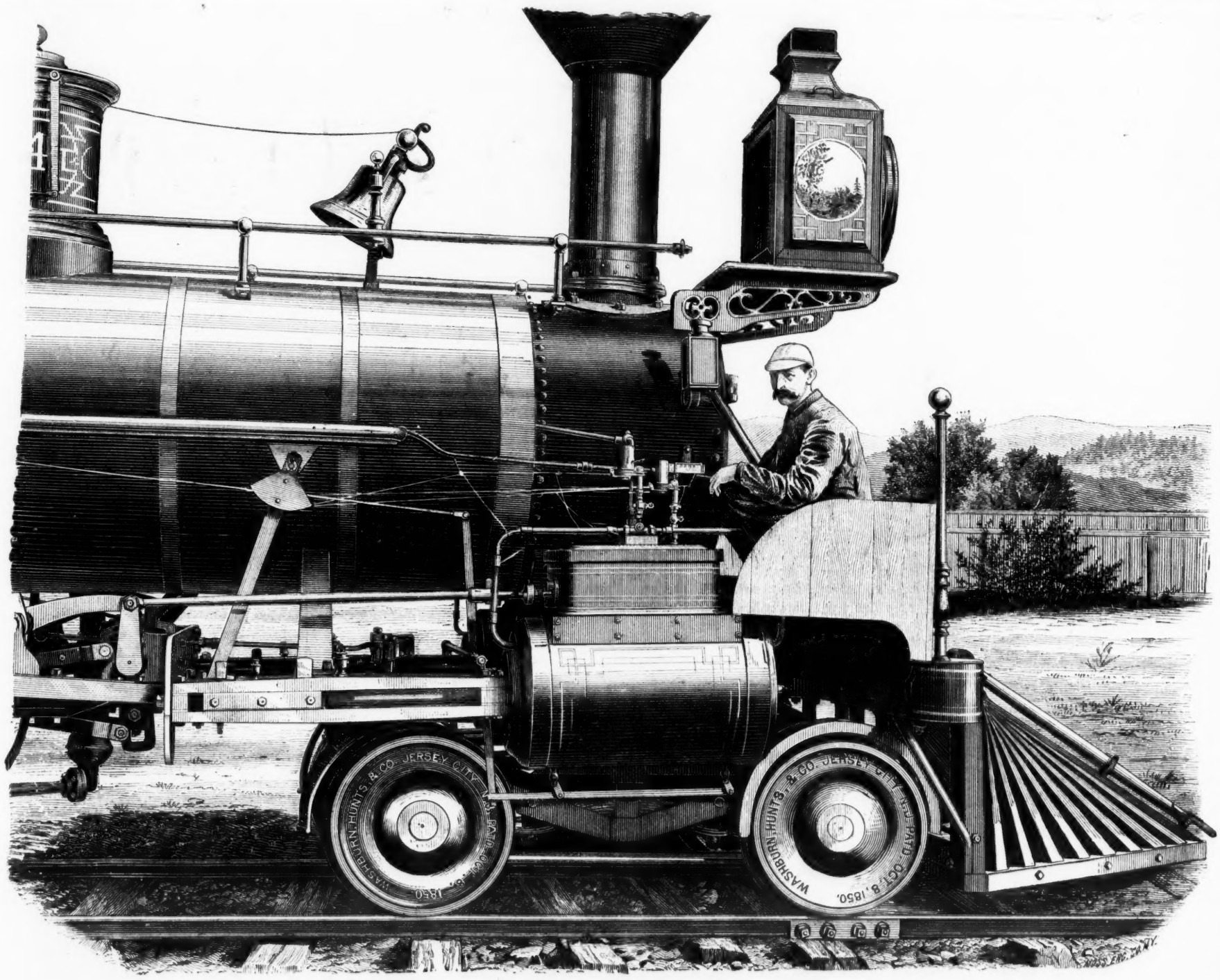


METHOD OF INDICATING A LOCOMOTIVE AT HIGH SPEED.

Method of Indicating a Locomotive at High Speed.

BY L. F. LYNE, M. E.

Until within a few years a large majority of practical engineers, railroad master mechanics and manufacturers have objected to the application of the indicator to their engines, considering the diagrams taken by that instrument as unreliable evidence of the condition of their engines. These objections, which gradually assumed the form of a prejudice in many, originated in the fact that certain engines were tested by different experts, who were considered fully competent to make such tests, yet, when the results were worked up, and a full report made, there was a vast difference in the horse-power shown to have been developed. These differences could be attributed to several reasons, as, the indicator might be of a poor design, or might easily get out of repair. I have known cases wherein cards were taken by an instrument which was faultless in its construction, but was improperly cleaned when last used; therefore the dirt caused the piston to stick, causing waves in the card. Sometimes the cause of the discrepancies referred to may be attributed to the faulty application of the indicator, and it is to the details of this particular operation that I wish to call attention.

The instrument may be an excellent one, and in perfect order, yet, if it is applied in a careless or imperfect manner, the results will not be correct.

The engraving upon this page represents the front part of Engine No. 94 of the Delaware and Lackawanna Railroad, Morris and Essex Division. Through the kindness of Mr. W. H. Lewis, the master mechanic, the writer was permitted to apply the indicator to this engine, which is employed in running a through express train.

The difficulties attending the application of the indicator to locomotives are numerous.

It is generally an easy matter to attach some form of motion for the indicator to a stationary engine, where there is plenty of room to work in, but upon a locomotive it is very different. The rigging has to be attached to the cylinder, and the operator has to take the cards while in a sitting or kneeling posture.

Upon a stationary engine there is little or no vibration of the engine or instruments, while upon a locomotive, besides the violent oscillations and vibrations; what may be called "the velocity of the air" approaches a hurricane, particularly while running against the wind. To give the reader a conception of the tremendous force of the wind, it may be stated that the writer, on one occasion, wore a tightly-fitting skull cap, which was as easily blown from the head as if it had been a loosely-fitting straw hat. To attach the paper to the drum of the indicator, and remove the same, requires a peculiar knack, as half the cards may easily be lost. In applying an indicator to a locomotive which is to run at a high speed, it is necessary to have large passages for the steam from the engine cylinder to the instrument. For freight engines, ½ inch iron pipe will answer very well, but for fast-running passenger engines it is necessary to have pipe of ¾ inch diameter.

In addition to the employment of a large pipe, the writer used no elbows, but wrought iron bends instead, bent to a radius of from 3½″ to 4″. A three-way cock was also employed, having openings of ⅝ inch diameter, and of an easy turn of about 1½″ radius. A

hard wood block should be fitted tightly between the three-way cock and steam chest to prevent vibration of the indicator.

The plug cock to which the indicator was attached was of the usual pattern with the exception of having an opening of $\frac{7}{16}$ inch diameter, which is the same size as the hole in the bottom of the indicator.

The ends of the pipes were well rounded with a file, so as to afford as little opposition to the passage of the steam as possible. The indicator pipes should be wrapped to prevent condensation.

It is astonishing that many good engineers, who will argue as to the friction in long and crooked pipes, seem to forget these principles when applying an indicator. I once knew one of these men, and a friend as well, to whom the foregoing remarks may well refer, who, in applying an indicator to a fast-running locomotive, used a ½ inch pipe with common elbows. He did not take the rough edge off the pipe, and placed a common tee joint in the center, upon which he attached the indicator. To further increase the complication, he placed a globe valve about 8″ each side of the tee joint.

The reader, if he be an engineer, can easily imagine some of the peculiar contortions through which the steam must pass in reaching the indicator. Instead of passing through an easy elbow formed by a properly constructed three-way cock, the steam will shoot directly past the tee joint, and being stopped by the globe valve, will react upon the instrument, causing a distortion of the diagram, especially at a high speed. It would be better to use two instruments, applying the indicators close to the cylinder heads, but this would be a very difficult matter upon a locomotive. It is believed that, by using the connections of the sizes recommended and used by the writer, the difficulties arising from friction of the steam will be very small. The next important step is the adoption of some reliable and efficient device for communicating motion to the paper drum of the instrument.

A simple lever is generally used, which is suspended by one end from a pin attached to the running board, usually at the outer edge, while the lower end is connected to the cross head. A screw is inserted sufficiently far from the top end of the lever to give the requisite motion to the paper drum of the instrument.

The objections to this arrangement are, that the cord, leading to the indicator, must be exactly at right angles with the lever, when placed in a vertical position, and even then the motion is more or less irregular owing to the arc described by the lever. The plan used by the writer is shown by Fig. 1, which consists of a lever *a*, of well seasoned cherry, three feet long and ¾ inches thick. It is provided with brass thimbles placed near each end, which are securely held in place by sawing through the center of the lever from the end to the thimble hole, and inserting a bolt through the lever edgewise just outside the thimble. By tightening the nut upon the bolt, the thimble is prevented from coming out, and the lever is not liable to split.

The bracket *b*, which is of ¼ inch iron, is held to the running board, so as to allow the connecting link *f*, to be attached to the inside of the cross head, a steel pin being inserted in place of one of the cross head bolts. The motion lever is placed inside the guides in order to avoid the vibration which would be experienced if the point of suspension were located at the outside edge of the running board. The travel of the piston is 24 inches, and is represented by *d*, *e*. The lever is suspended, so that the vibration may be equalized, by allowing the pin in the lower end of the lever to travel an equal distance above and below the line *g*, which is one-half the versed sine of the arc described by the lever. The lever must be made short enough to allow of this adjustment, and a block put under the bracket *c*. Motion is communicated to the paper drum of the indicator, by means of the grooved arc *c h*. This arc is made from the same material as the lever, ¾ inch, and has a groove, flat, and ⅜ inch wide, at the bottom.

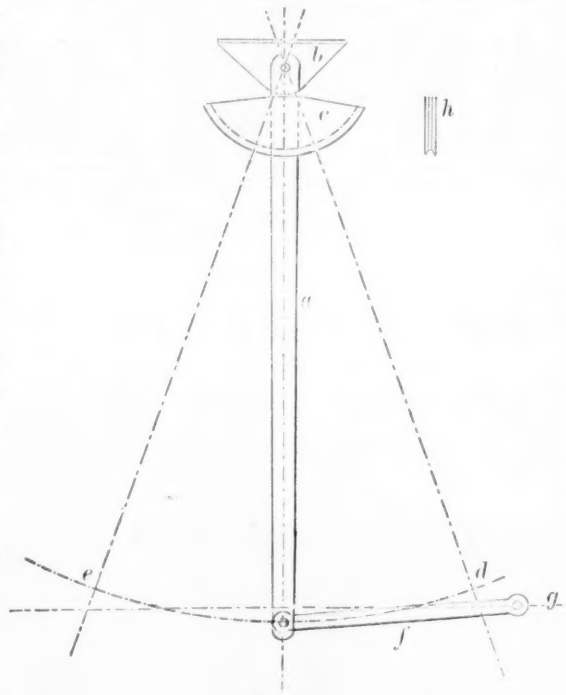


FIG. 1.

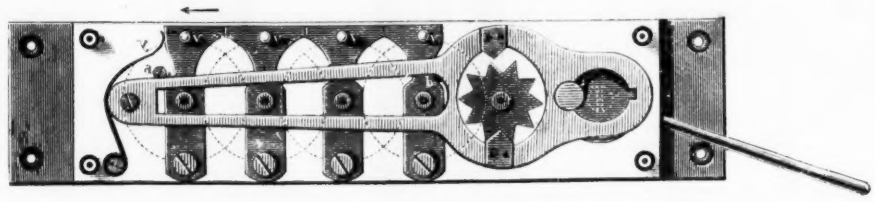


FIG. 3.

FIG. 2.

The ratio of motion between the paper drum and the end of the lever being known, it is an easy matter to get the radius of the arc *c*, which had better be turned up in a complete circle, and the necessary sized segment cut out afterwards. The motion of the paper drum should be proportioned so as to make the diagram 3½″ long, as a card 4″ long will cause more fling to the paper drum and there is more difficulty in getting them all of the same length.

A long, slim card is also more deceptive, as it does not show up to advantage, while the same area put into a short card conveys a much more favorable impression. The lead and compression seem to be modified on account of the curves being shorter.

This apparatus, when once made, will not require changing for any engine of the class mentioned. By the use of the grooved arc *c*, which is not a new principle, the cord may be led off at any angle in line with the motion of the lever *a*, and yet rely upon a uniform speed of the cord. Two indicators were worked from this device, one being placed upon the cylinder and one upon the steam chest. A cord connecting with each instrument was placed at each side of the groove; each worked without interfering with the other. The counter which was used to count the number of revolutions is shown in Fig. 2, with the exception of having only three figures instead of five. Instead of the lever *H*, the writer placed a back upon the counter and used a vertical lever, as shown near the hand of the operator in the illustration upon the first page. This lever was operated by a cord attached to a screw at the back of the lever *a*, Fig. 1, the cord drawing it back, and a spiral spring attached at the brace in front, drawing it forward. To ascertain the number of revolutions per minute, the lever which worked the counter was pressed by the hand, stopping the vibration. A reading was taken, which in a certain case was 855. The counter was allowed to run exactly fifteen seconds, when it was stopped by pressing the lever as before, and a second reading taken, which was 937. I then subtracted the first from the last and multiplied the difference by four, which gave 328, the total number of revolutions per minute, which, with a driving wheel of 61½″ diameter, was a speed of approximately one mile per minute.

It was found that there was less variation in the speed by counting only fifteen seconds than when a longer period was allowed, as well as effecting a saving of much time. A sectional view of the counter used is given in Fig. 3, showing internal construction. When a diagram was taken the engineer recorded, with a piece of chalk upon a slate, the boiler pressure, also the point of cut-off, which were exposed to the view of the operator, and were by him noted upon each card. It is thus possible for one man to take the diagrams and note the speed, besides recording the boiler pressure and point of cut-off.

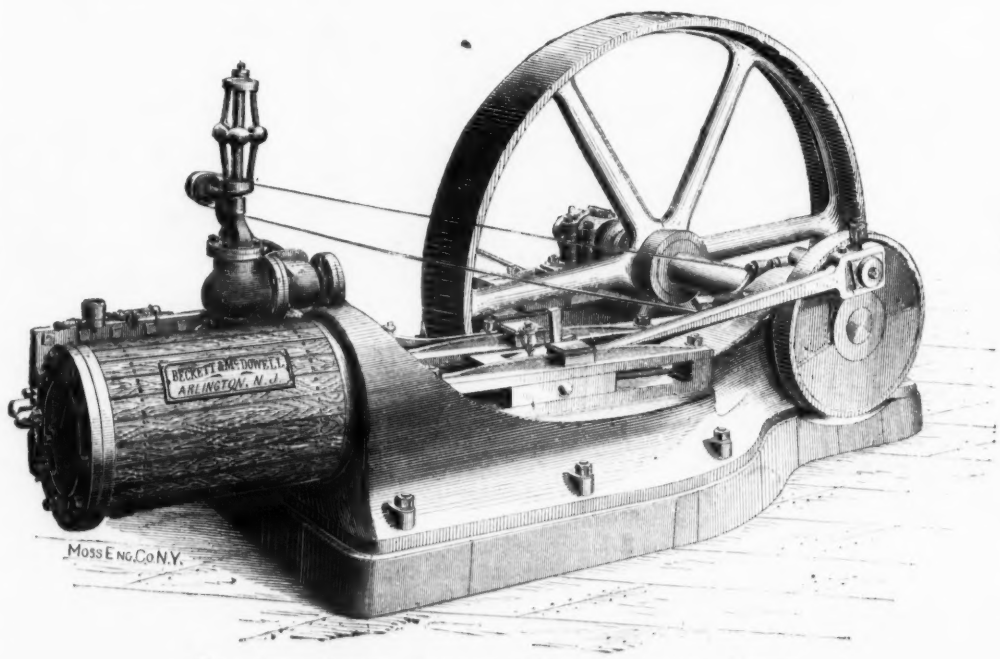
The indicators used were Tabor's patent, invented by Mr. Harris Tabor, of Corning, N. Y., and made by the Ashcroft Manufacturing Co., Boston. This indicator was described at length in the AMERICAN MACHINIST of May 8, 1880.

This is the first time to my knowledge that the Tabor indicator was ever applied to a locomotive, and it worked very nicely; not a cord was broken during a ride of 420 miles in a box 18″ wide and deep, and 30″ long, upon the bumper beam of an express engine. Some cards were taken at a piston velocity of 1,312 feet per minute. No difficulty was experienced in hooking on the cord of the indicator even at a speed of 328 revolutions per minute. Light wire hooks were used upon the cord attached to the instrument, and a wire loop upon the part leading to the motion lever. The end of this cord was fastened to the indicator, in order to pick up the ring more readily.

The cards will be shown in a future issue of the AMERICAN MACHINIST.

High Speed Stationary Steam Engine.

Since the benefits of high speed have become an undisputed fact, the attention of manufacturers has been directed towards the production of an engine which would possess the most advantages in developing a certain horse-power. The firm of Beckett & McDowell, office 17 Courtlandt St., New York, have succeeded in bringing out an engine that is well calculated to give good results in running at high speed. The engine of this class, represented by the accompanying illustration, was build for the "Cusihiriachic" mine in Chihuahua Co., Mexico, and is now driving a twenty stamp iron frame battery, besides other machinery.



HIGH SPEED ENGINE BUILT FOR MINE, CHIHUAHUA, MEXICO.

In this engine, the trunk style of bed has been adopted, as being the best to insure rigidity under all conditions, thus avoiding much of the trouble from hot journals that exists in some engines having common girder and frames. The guides consist of double bars, bolted to the bed, with a simple distance piece between, by which any wear can be properly and permanently adjusted (either vertically or horizontally) in a very short time. This style of guides has been in use on locomotives for many years, and has been found to give the most favorable results upon fast running engines. Having no connection with the steam cylinder, they are free from the objection so frequently urged against the circular guide, of unequal wear from the expansion of one end, due to the heat of the cylinder. The cross head is of unusual length, being not less than four-fifths of the stroke. With a large area of bearing surface, the tendencies to wear and heat are reduced to a minimum. The piston rod, valve rod, crank pin and cross-head pin are all made of the best machinery steel. All the connections are fitted with steel bushings and pins. The crank shaft and connecting rod are made of hammered iron. The crank end of the connecting rod is forged solid, no strap being used. The brasses are set up by a wedge extending over the whole surface of the back of brass, and held in position

by two steel bolts. The crank disc consists of a large disc plate, turned true and weighted on one side, so as to balance the pin and connecting rod. The valve rods work in substantial guides at both ends, thus relieving the stuffing box and gland of all unnecessary weight and unequal wear, and enabling the valves to work perfectly free. The fly-wheels, though reduced in size, are of ample weight, and are balanced, being turned true for the application of a driving belt. The outboard pillow block is of unusual length, and is adjustable upon a sole plate.

The engine shown in the illustration is compact, strongly built, maintains a steady speed and is furnished at a low cost. All parts are easy of access for inspection and repair. Any part may be duplicated as the standard systems of gauges are used. These engines are furnished with or without cut-off valves, as desired.

Sizes of cylinders from 10″×15″ up to 20″×30″.

The works are at Arlington, New Jersey.

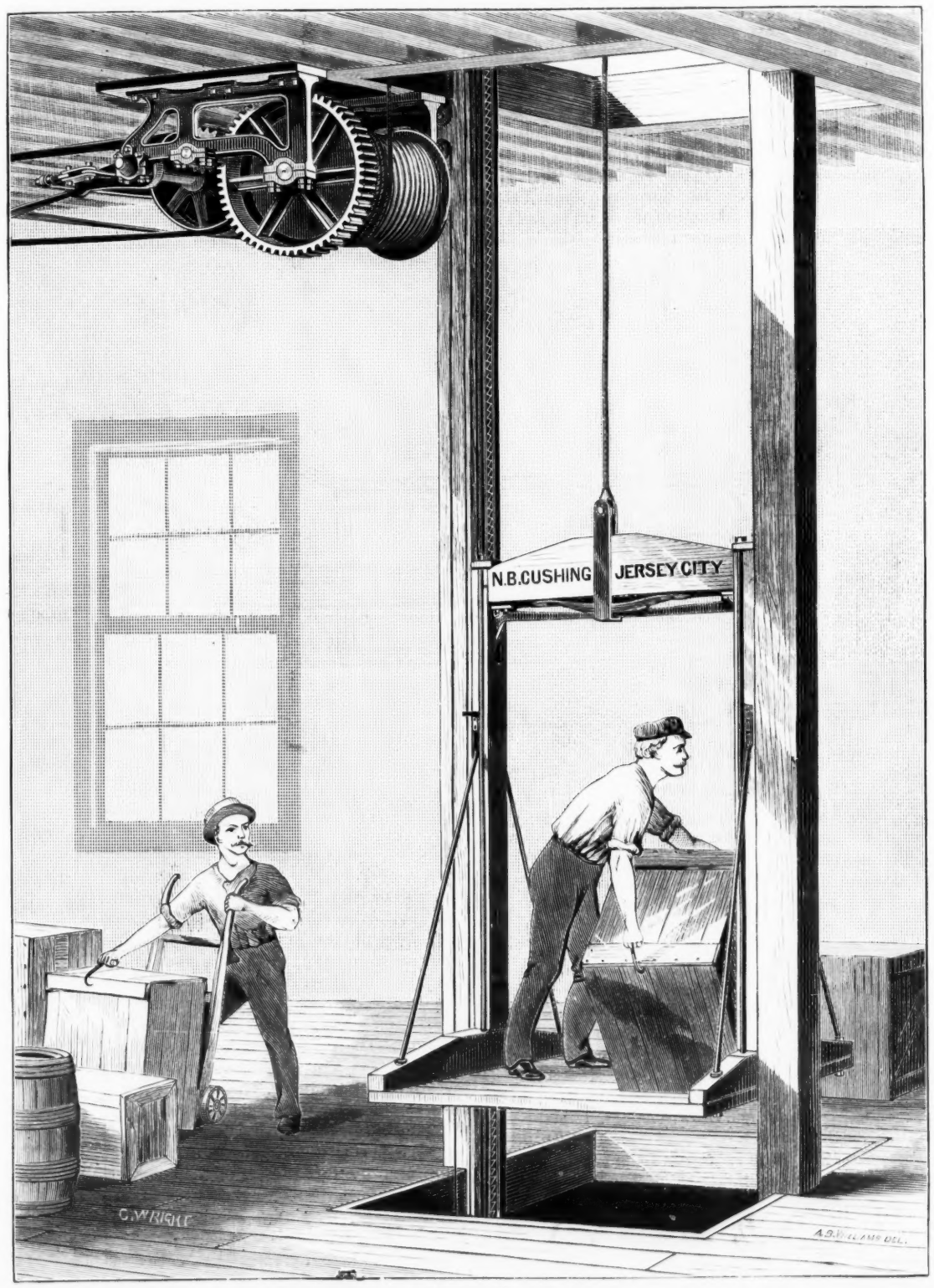
In a pungent editorial, the *Iron Age* takes British free-traders to task for a covert attempt at protection, which accords very ill with their pretensions to consistent advocacy of free-trade principles, by saying:

"The order in Council requiring the slaughtering of American cattle on their arrival in port, without reference to whether they are well or sick, is as much a measure of protection as the duty on steel rails, or the law prohibiting the registration of foreign-built ships. It is intended solely and wholly for the advantage of British cattle raisers and the benefit of Canada. The shallow pretense that it was needed to protect British stock from infectious diseases imported from the United States has no reasonable basis, inasmuch as the proportion of sick to well cattle brought to England, even after the confinement and exposure of a long voyage, was very much less than that among British herds in pasture. Only 137 out of 76,117 head of cattle imported from the United States were sick, and these were said to have pleuro-pneumonia. Good authority places the decrease of British cattle and sheep from distemper and other diseases last year at 1,322,865 head. The real reason for this famous order in council was that it would place obstacles in the way of profitable importation of American cattle. Beef killed before it has had time to recover from the effects of a long sea voyage, would not be as good as if allowed to graze a week or two, and the loss of meat killed on the coast is much greater than it would be if imported alive and driven on foot to where the meat was needed. Here we have protection pure and simple—not an honest import duty which, known to all exporters, becomes a part of their calculation, but a vexatious obstruction to trade intended to discourage beef importation from the United States and to encourage cattle raising in Canada. All things considered, England's pretensions in the matter of free trade are utterly dishonest. She does not protect her industries now in the sense in which we protect ours, but she did as long as it was any advantage to her, and would do so again if she saw her way clear to make anything by it. We repeat that complaints of the American tariff on the part on England are a gratuitous impertinence, and should be resented as such by every self-respecting American citizen.

It is proposed to start a glucose factory in Aurora, Ill., with $60,000.

Safety Power Elevator.

For freight purposes the geared power elevator is probably the most extensively used, and might be termed the standard elevator. This style of elevator is represented by the accompanying engraving. It has been used long enough to enable the builders to eliminate most of its defects, and it is at the present time one of the cheapest, safest and most economical of all the various devices known for the purpose for which it was designed. When such an elevator is available, it is very unwise in business houses and manufactories to pay help for carrying goods up and down stairs by main strength and stupidity. Steam and water power are so extensively used that an efficient elevator can be easily and economically obtained. The power which is to work this elevator is derived from two belts running upon tight and loose pulleys. Through the medium of pinions, the power is transmitted from the counter shaft to the large gear, carrying the drum upon which the wire rope is wound.



Safety Power Elevator.

This drum is turned and grooved for the wire rope, and the pulleys and boxes are self-oiling. The cars are provided with efficient safety devices, and are accessible from two or four sides. The power machine may be attached to floor beams, or any convenient framework, where it may be out of the way. This style of elevator requires very little attention, and is not liable to get out of order. It is manufactured by N. B. Cushing, Jersey City Machine Works, foot of Morris Street, Jersey City, New Jersey.

Among the hundreds of inventions which have been made and patented in this and foreign countries, we have failed as yet to notice one which is demanded by thousands of small mills, and which, if placed in the market in the form of a cheap and easily applied device, would meet with a large sale in the class of small mills where changes of grist are frequent. The invention we refer to is a device for throwing the millstones apart when the stream of grain running into the eye is stopped from any cause, accidental or otherwise. The mechanism necessary to accomplish the desired end need not be at all complicated or expensive. Let some of our ingenious readers take the matter in hand.—*North-western Miller.*

Iron Sleepers.—The use of iron sleepers is becoming general in Germany. The Berg-Mark Railway exchanges all the worn out wooden sleepers for iron ones. Tenders were received the other day by the Royal Prussian Railway Board for 5,000,000 kilos. of iron sleepers.

Electric Indicator for Steam Boilers.—It is said an electric boiler indicator has been brought out in France, by means of which the water level in a boiler may be ascertained at any distance from the boiler. A tablet is connected with the electric indicator, which is fixed at the top of a vertical tube above the boiler, by two electric conducting wires. An index, a battery and a bell complete the apparatus.

Extracts from Chordal's Letters.

Mr. Editor:—What do you know about machine shop floors? When the good manager builds his shop he shows on a plan the proposed position of every machine. Maybe he don't intend to get these machines right away, but he makes his calculations for them, and when they do come he can put them in a place reserved for them.

But one thing he cannot do, and that is to put in all his foundations before his floors are laid. No man living can predicate a foundation for a lathe or a planer or any other machine tool. Some tool makers even cannot furnish a foundation plan till they have the machine built.

Then again the good manager never gets the tools he first intended to get. His experience in the shop causes him to alter his mind, or he sees some machine in the meantime which takes his eye, or he finds out that the machine he had in his mind is not just what he thought it was.

* * * * When a new lathe or planer or drill, or slotter comes into the shop there is always a worry about where to put it. Sometimes the thing is settled by putting it in the best-looking vacant spot in the shop; say in the middle of the setting-up floor. Again it will be put in among a lot of machines of an entirely different character. This often leads to smal machines for light work being set in among heavy tools whose big work can be got to them by cranes, tracks, &c., &c. Sometimes the whole question is settled by the convenience of locating a countershaft.

The new tool calls for a certain amount of floor room and a certain amount of ceiling room, properly located with reference to the floor room. When the spots have been found, and the machines set up, it is often found that the question of daylight has been left out of consideration; that the daylight comes in the wrong direction, or that it don't come at all.

* * * * Some men, when a new tool is added to the shop, are smart enough to look into all the requirements. This often leads to a total reorganization of the shop; a general twisting around of things; the moving of this lathe and that one, and that planer, and this shaper, and both those slotters, and maybe half a dozen more.

* * * * When the shop is run by such a man, the said shop is liable to get turned upside down every time a new tool is bought. He is probably reorganizing six months out of the year, and when a lathesman goes home at night he don't know what part of the premises he will find his lathe in when he comes to work in the morning.

The shop under such management is most always a nice appearing and convenient shop, if you can spy into it some day when it isn't being reorganized. * * * *

This kind of business don't pay very well, for it is my experience in machine shops that you can't get much work out while the line shaft is being moved, or lengthened out, or raised, or slid endwise, or while half the countershafts are on the floor, or while the floor is half ripped up.

* * * * Aside from other inconveniences attending the arrival of the new ma-

chine, the floor work is enough to call for resolutions of reform.

If there is plenty of room for the new machine, both on the floor and on the ceiling, and if there is plenty of daylight coming from the right direction, and if the aforesaid spaces are in exactly the right location, still the job of putting the tool in place is a demoralizing one.

There must be scientific sighting, and measuring, and chalking on the floor, and the floor must be torn up, and diggers must excavate and pile the dirt out in the shop, and mules and drays find their way into the shop, hauling out the dirt and hauling in the stone. And then the masons work awhile, and then the floor gets put down, and then the machine gets set, and belted up, and started. Maybe there has been a slight mistake somewhere, and the machine does not stand on the foundation at all; but that makes no difference, of course. It is so desirable to get this job over, that a matter of a foot or so in the matching of things cannot be considered.

* * * * Some men point with pride to a floor which is foundation all over, so that they don't have to tear up, and dig, and build, &c., &c. This is all very nice, but if it means a brick floor for a machine shop, I, for one, can stand the digging.

If anybody can show up some kind of decent floor, which rests directly on bottom, solid enough to carry heavy tools properly, I wish he would unfold himself.

* * * * I have seen floors built right in well packed earth, and no foundations were needed for ordinary shop tools, but I have noticed that the floors are always rotting out and smelling bad.

If such floors would last and be healthy they would be just the thing for ordinary shops.

The fact that once in a while some tools require a pit, need not detract from the virtues of the floor. Much better to dig two or three pits than forty or fifty.

* * * * I once worked with a genius who had put a common floor in his shop—an *awfully* common one in fact. It was on 12″ joists, and was open enough in some places to let a small monkey-wrench through. I don't suppose there was a square foot of that floor which at some time some workman had not torn up in order to recover a scale, or a pair of calipers, or a chisel, or a job, or something.

Under each machine there were two or three loose trap doors, and all the chips and other hard accumulations of the shop were shoveled into these holes.

This would be pretty expensive in some localities, but at that place this stuff had no value.

In course of time there was a heavy stratum of hard iron under the floor in the neighborhood of the machines. Care was taken to flush all parts up nicely, and then the traps were nailed down. Then traps were put in other parts of the shop, the intention being to put solid iron under the entire floor. When a section was well filled and set, a good floor was laid, and it was able to stand up under any machine likely to be set upon it.

This all looked very well, but I should hardly fancy the job of excavating a pit in this floor for a long-spindled boring mill.

* * * * There may be some kind of a floor which will endure, and be neat and healthy, and which will do to set machine tools on without any underpinning or foundations. If there is, I should like to know what sort of thing it is.

* * * * I am informed that English law makes real estate out of anything attached to a building. Thus, if you rent an empty factory and fill it with machinery which you bolt to the floor, the machinery so bolted becomes a contribution and a part and parcel of the premises, and is not to be removed by you when your lease is up. This condition of law has led to the contriving of a plan to get around it. Instead of bolting your machines to the floor, you bolt them to shoes previously bolted to the floor. When you buy a new machine, it comes with these shoes on its feet. You fix the shoes to the floor, and then fix the machine to the shoes. When you clear out, you take your machines, but leave the shoes as a souvenir of your respect for the law.

* * * * In European shops, paved floors are common; so are steam engines and drilling machines attached to the walls of the building; and so is "laying off" on Saturday, and sobering up on Monday. The absence of all washing conveniences, too, is universal in English shops.

Europe has lots of machine shop ideas which we would do well to filch, but it is to be hoped that we will never import the above mentioned features.

* * * * Why don't some smart lathesman sit down and send you a dissertation on finishing work in a lathe. Not one lathesman in a hundred knows how to put a decent polish on a job. When I was out at the Millers' Exposition, I heard machinists talking about the nickel plated work on the Wheelock and Brown engines. I did the same thing myself at the American Institute in 1876. The finish was so far beyond my own understanding of things, that I supposed of course it was plated. I afterwards satisfied myself that what I saw was iron with a good finish on it.

Almost every lathesman understands that finish is simply a nice arrangement of scratches. He knows that he can file big scratches out of a job, if he is lucky enough not to file a few bigger ones in; and that he can use a finer file and get the scratches still finer; and that he can take emery clamps and grind the scratches still finer. Here he generally ends, and his finish is nothing to compare with the fine work stuck right under his nose every day. He sees work in which the scratches are so fine that he can't see them at all. He wants to know how the fellow who did this job managed to get big scratches out and to get such little scratches in. Such finish as this is real polish. It isn't a temporary polish put on top of a wretched finish.

Proprietors are interested in this question of finish. They want their work finished, but they have an idea that it costs too much money. The fact is that it don't cost much, not as much hardly as common finish. It is a notorious fact that high-finish shops can get away with other shops on prices. There are, of course, other reasons for this; but it shows that finish does not conflict directly with cheapness.

The real truth is, that in certain shops the men know how to put a finish on work, and the expense is nothing. In other shops, doing tip-top work, the men don't seem to know anything about it, and any attempt that way involves discouraging expense.

* * * * Almost any observant mechanic can write a long treatise on "Finishing, Practically Considered." I even believe I could fill two or three columns of your paper myself with instructions and general principles, and hints on choice of material, etc., but it would not be worth the paper it was printed on. I never succeeded in putting a finish on a job in my life which was not a disgrace to the shop and myself.

* * * * What I want to see is a letter in your paper from some smart lathesman who not only knows how to tell about finishing, but knows how to do it.

* * * * Very respectfully,

CHORDAL.

In the establishment of this newspaper, which has three large boilers and a large double engine, and runs several presses and folding-machines, besides pumping all its elevator water, supplying a stereotyping department with hot steam, and heating its building with steam, involving a large consumption of coal, smoke has been reduced to a minimum. This revolution has been accomplished by three simple improvements, each of which saves money as well as contributes to the abatement of the smoke-nuisance. In the first place, the chimney was carried up about eighteen feet higher than it was originally built, and this gave it sufficient draft to supply the exigencies of the fire. In the second place, constant vigilance has induced the engineers and firemen to "stoke" the fire in a rational and economical fashion. And, thirdly, it has applied the Orvis smoke-consumer, which supplies the necessary oxygen for the combustion of the surplus carbon in the shape of smoke, at all times when the fire is not chilled and a great volume of black smoke produced by too heavy and careless firing.—*Chicago Tribune.*

A man of a mechanical turn took off his gas meter to repair it himself, and put it on again upside down. At the end of the quarter it was proved that the company owed him $15.75.

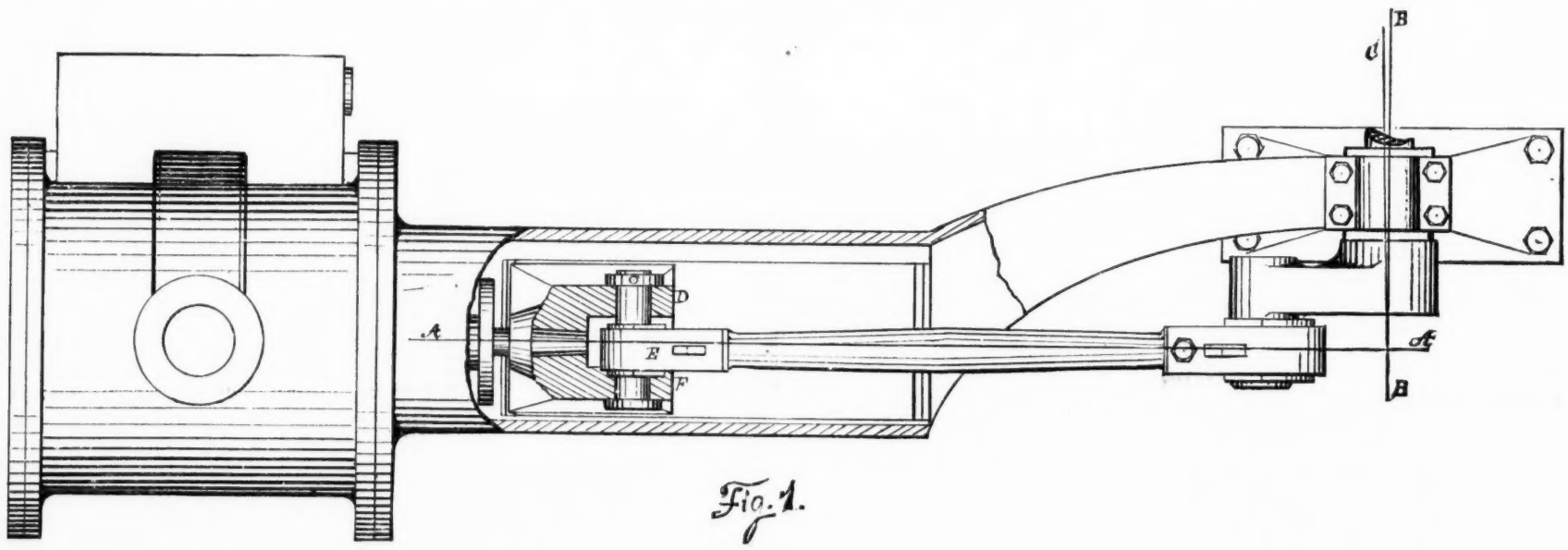


Fig. 1.

Glass Millstones.

The idea of constructing millstones of glass is said to have originated from the observation that the finest flour was produced by those millstones which have the most glassy texture; from this observation came an experiment which demonstrated that pieces of glass, combined in the same way as the French buhr, and similarly grooved on their surfaces, gave results in grinding. The outcome of this successful experiment, says the *Pottery Gazette*, was the invention, by the Messrs. Thorn, of the glass millstones now made by them, and used in Germany with much satisfaction. Respecting their special merits, we learn, on the same authority, that they grind more easily, and do not heat the flour as much, as is the case with the French buhr-stone. In grinding grist they run perfectly cold.

In making these stones the glass is cast in blocks of suitable size and shape, joined with cement in the same way as the French buhrs, dressed and furrow-cut with picks and pointed hammers. It is suggested that the substitution of diamond dressing machines would give better results.

The *Sanitary Engineer* says: "An enterprising Bostonian is going to give Holyoke, Mass., 'daylight' the year round by means of electric lights of 300,000 candle power. These 'suns,' seven in number, are to be placed on towers, 75 feet high; and in this way the inventor expects to obtain an illumination equal to, if not superior to the sun. Experience is an expensive, but very efficient teacher.

Setting Engines in Line.

BY JOSHUA ROSE, M. E.

No. 1.

The following directions will enable an engineer to test if the axial line of the shaft of an engine is at a right angle horizontally with the center line of the cylinder.

When an engine is put together, and its being in line requires to be tested, it may be tested by connecting the connecting-rod in various ways and testing with it the crank pin and cross-head journals. This method is very accurate, because the actual amount or degree of the error is magnified in appearance owing to the length of the connecting-rod.

In Fig. 1, let *AA* represent a line true axially with the bore of the cylinder, and *BB* a line at a right angle to *AA*, and passing through the center of the pillar block or bearing spaces. If the engine was in line, *BB* would be coincident with the axial line of the crank. Suppose, however, that *BC* represent the actual center line of the crank; not then being at right angles to *A*; the end *E* of the connecting-rod, if connected to the crank pin, as shown, and made a good working fit so that there is no play of the pin in the brasses, will not come fair, laterally, with the bearing in the cross head. The amount of the error is the amount it is out of true, in the length of the crank pin journal, multiplied by the product of the length of the connecting-rod (from center to center of the bores of the brasses) divided by the length of the crank pin journal. It is apparent, however, that if the crank shaft be set to have its axial line at *BB* instead of at *BC*, the error at *ED* will be corrected, and

thus we may employ the connecting-rod to set the crank shaft in line.

It is, however, not sufficient to try the crank on one dead center only (as will be seen presently), hence we place it on the other and move the cross head to the other end of its stroke, and again try the end *E* of the connecting-rod with the cross-head journal, and if it falls to one side and *on the same side as before, but to a less amount*, it demonstrates that the axial line of the crank forms with the line *AA* an acute angle. If, however, instead of falling too much laterally towards the side *F* of the cross head in Fig. 1, it fell too much towards *D*, but more so when tried with the crank on the dead center nearest to the cylinder than when tried with the crank on the other dead center, then it is proof that the axial line of the crank shaft forms with *AA* an obtuse angle.

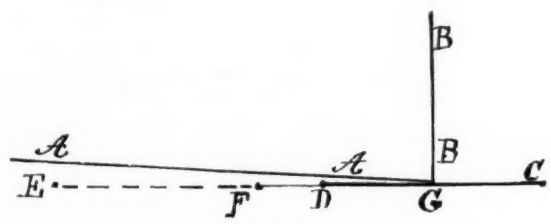


FIG. 2.

The reason that the error will be more plainly shown with the crank on one dead center than when on the other is shown in Fig. 2, in which *AA* is a line coincident with the axial line of the cylinder bore, and *BB* the axial line of the crank shaft, from *C* to *D* is the plane of revolution of the crank pin, while *G* represents the crank center. The points at *C* and *F* denote points central to the length and diameter of the crank pin journal. Now, the center line of the connecting-rod for one dead center is represented by *ED*, and for the other by *FC*, and it will be seen that the point at *E* is further from it than is the point at *F*. It will be observed that the point *D* falls *outside*, while the point *C* falls *inside* of *AA*, and yet the center line of the connecting-rod stands, in both cases, at the same angle to the center line *AA* of the engine, and in both cases throwing the end of the connecting rod, represented by the points at *EF*, *outside* of the line *AA*.

If the connecting-rod bed does not, when connected to the engine, as in Fig. 1, fall true into the cross-head bearing, the error is the same *in amount* and comes on the outside of the cross-head journal with the crank placed on each respective dead center, it is proof that either the flange of the crank shaft brass (which is between the crank face and the frame) is too thick, or the inside flange of the connecting-rod on the crank pin is too thick, or else the crank is too thick, measured from the crank pin journal to its inside hub face, the error being in the new crank or new brass, if one has been put in.

It may here be remarked that if the bore of the crank-pin brasses of the connecting-rod is not at right angles to the center line of the rod itself, the end *E* (Fig. 1) might fall either inside or outside, laterally, of the cross-head bearing, but in this case the error will show more at one end of the stroke than at the other, for reasons which are explained in Fig. 2; hence it follows, that the connecting-rod brasses should be properly fitted to their journals, and made to lead true before using the rod to line the engine by. In some cases it is more convenient to connect the rod at the cross-head end, and try the other end with the crank-pin journal, as shown in Fig. 3. In this case, however, the connecting-rod will (whenever the axial line of the crank-shaft is out of square, forming an acute angle with the center line *AA*, as in Figs. 1 and 2), fall laterally inside the crank-pin journal, when on one dead center, as in Fig. 4, and outside whenon the other dead center, as in Fig. 5, the respective amounts of error being in this case equal for the two positions. The reason for this is that the plane of revolution of the crank pin falls outside of the center line in one case, and inside for the other, as shown in Fig. 2 at *D.C.*

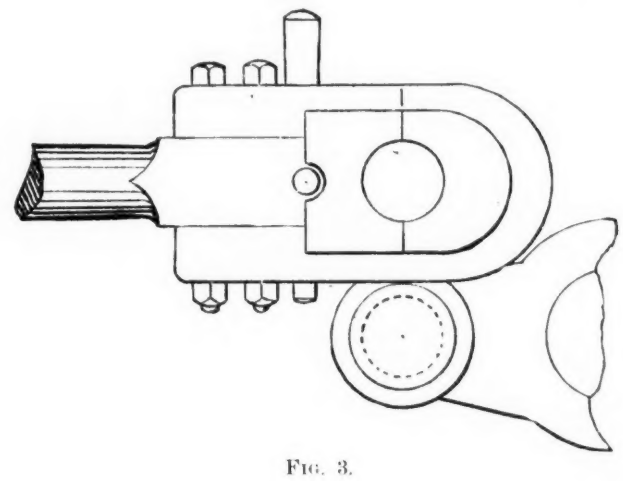


FIG. 3.

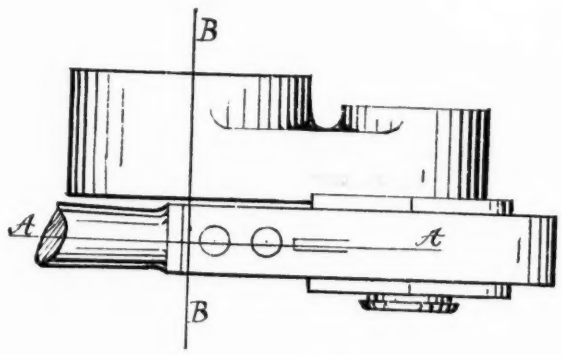


FIG. 4.

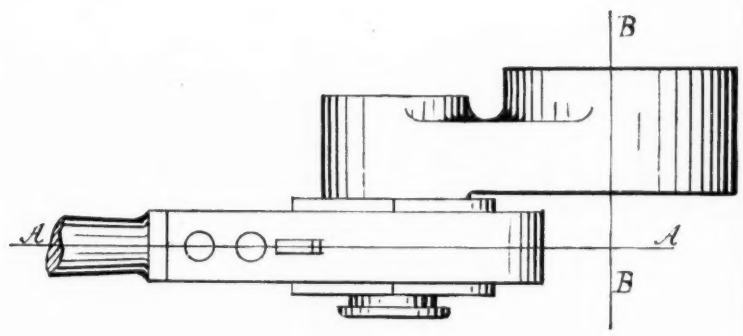


FIG. 5.

If the axis of the crank axle, formed an obtuse angle to the engine center line *AA* in Fig. 1, the connecting-rod end tried with the crank pin, as shown in Fig. 3, would fall outside of the crank-pin journal when the latter was on the dead center nearest to the cylinder, as shown in Fig. 6, and inside of the crank-pin journal when on the other dead center, as in Fig. 7.

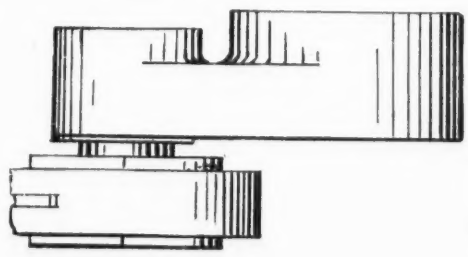


FIG. 6.

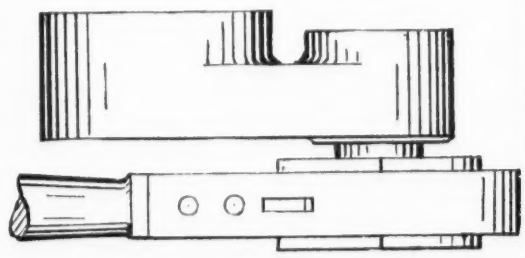


FIG. 7.

SOLID MUCILAGE.—Mucilage in convenient solid form, and which will readily dissolve in water, for fastening papers together, may be made as follows: Boil one pound of the best white glue, and strain very clear; boil also four ounces of isinglass, and mix the two together; place them in a water-bath—glue kettle—with half a pound of white sugar, and evaporate till the liquid is quite thick, when it is to be poured into moulds, dried and cut into pieces of convenient size.

Owing to action taken by the Western Nail Association at Pittsburg, at their recent meeting, nails were advanced to $3.00, being a net advance of 15 cents per keg. This was done on account of the recent rise in pig iron.

From the large number of glucose establishments starting up in various parts of the West, it is reasonable to infer that the profits must be large. As an example: In a late suit in Buffalo the inventor and patentee of the new process "sugar," who is now out of the business, told the secret of the trade. He testified that a bushel of corn, costing, say, 45 cents, may be turned into thirty pounds of glucose at a cost of 25 cents, and the product be sold at a net profit of 70 cents. Mr. Alberger, the plaintiff in the suit, set the present value of his 23 shares in the Buffalo Grape Sugar Company at $450,000, and these shares represent but little over one-tenth of the whole capital stock of the concern.

That there is a great deal in Mr. Edison's inventions cannot be disputed; but wouldn't it be wiser on his part to make one thing an established success before commencing on another, and thus have compassion on the investing public? We like to give inventors all the encouragement possible; but then they must not only invent—they must finish. Mr. Edison has been amusing himself by crying "Eureka!" far too long; by the time he has found something worth talking about, confidence in him will be gone.—*Puck.*

Advantages of High Speed Engines.

BY CHARLES T. PORTER.

NO. 13.

Although I must assume that the readers of this article have read the preceding ones of the series, still I hope, that in the long time since the last one appeared, the number of readers of the AMERICAN MACHINIST has so increased that to the majority of them the subject will be new.

A criticism has been made on the last paper, that nothing was said in it about back lash in gearing. The reason was, that there was nothing to be said about it, unless the example were followed of the author of the Treatise on Snakes in Ireland. I preferred to follow the example of the engine itself, and maintain silence on the subject. This subject being opened, however, it may be said that the reasons why back lash is impossible in a properly connected high-speed engine are two-fold: First, the close approximation to uniformity of rotative effect, and second, the momentum of the fly-wheel, which is in excess of that of any or all of the driven machinery.

There remains to be considered the method of transmitting power by belting, and about this there is really not a great deal to be said. True, it is easy to write voluminously on this as on any other subject, but the gist of the matter may be given in few words.

The more swiftly a belt runs, the more power it will transmit. If a belt has lumps at the joints, or contains soft pieces, or the pulleys run out of true, or have an irregular motion, swift running is not practicable; but when all conditions are what they ought to be, the limit to the speed of a belt is only found when its centrifugal force, as it is deflected around the pulleys, prevents it from maintaining the necessary adhesion to their surfaces. Up to this limit, a good belt on true pulleys, and receiving a uniform motion, should run so steadily and smoothly that one must be close to it, to determine whether it is running or standing.

Now, with a given number of revolutions per minute, centrifugal force increases directly as the diameter of the circle, or directly as the velocity; but, in a given circle, it increases as the square of the velocity.

To illustrate the application of this rule: If we wish to double the velocity of a belt, we can do it either by doubling the diameter of the pulley, or by doubling the number of revolutions of the same pulley. In the former case we double the centrifugal force, in the latter we quadruple it. So the larger the pulley the more swiftly the belt can be run.

On this account, and because they involve less compression and extension of the opposite surfaces of the belt, in being bent around them, large pulleys are to be preferred to small ones where great velocity of belt is required.

While this is true, without any limitation, still, for speeds not exceeding 5,000 or 6,000 ft. per minute, pulleys of nine ft. or ten ft. diameter are ample, so that, practically, the pulleys employed on slow-moving engines have no advantage, but the high-speed engine alone can give, from pulleys of moderate size, that velocity to belting which is its life. Any one can compute the centrifugal force of a belt, by knowing that the centrifugal force of 1 pound, making 1 revolution per minute in a circle of 1 foot radius, is .000341 of a pound.

American engineers are entitled to the credit of discovering the value of velocity in belts; in fact, American belt makers only know how to make a belt. English belts, when I was in England, were not only run very slowly, but were not fit to be run at all, and were never used when gearing could be employed. Common narrow belting was put together without any regard to line or thickness, showing nearly double thickness and a dog's leg at every joint; and the ends were always united by lapping them for two or three feet, and sewing the two thicknesses through and through with sheepskin lacing. Twelve inches was the greatest width known, and wide belts were always double, and were sewn from end to end with lacing in rows about two inches apart, and so touched the pulleys only on the knobs of the lacings; and the ends, often five-eighths of an inch thick, were lapped together in the same manner as those of the narrow and single belts. When one looked at these belts wriggling along at five or six hundred feet a minute, as a maximum speed (often not two hundred feet), he was not surprised to be told that belts were not much thought of, in England.

The *Scientific American* says: No such engine as the "Baxter" or "Diamond" is made in Germany, though gas motors are much used.

Bits of Experience.

BY PROF. JOHN E. SWEET.

No. VII.

Has any one ever known of a flanged pulley that did not act as if it wanted to get the band on the flanges? We have a rig with the flanges cast on the frame, and a plain flat pulley running between them. The band does not seem to possess the propensity for riding on the flanges, shown by belts operating on the old style.

* * * * * *

Henry Watkey, Master Mechanic of the N. Y. C. Railroad, has invented a way to put in false seats on locomotive cylinders, so they do not leak, nor get loose, nor take time to change. The plan is simply to make the cylinder face flat; the false seat flat; to cast projections in the chest to hold the seat in position, and trust to steam pressure to hold it down, which, of course, it does, better than all the tap screws possible. Taking a hint from this, the same principle was applied to a Baxter engine being repaired in our place. The steam chest of the Baxter engine is, as is well known, in the boiler, and is forced to its seat by steam pressure when the steam is throttled. Those who, from necessity or curiosity, have taken these steam chests off, have experienced great difficulty in getting them tight again. Understanding the facts in the case, I prevailed on the man fixing up the engine to make a good fit of the chest, screw up the bolts with his fingers and let it alone. It was all right and will likely remain so.

* * * * * *

My experience with taper shank drills leads me to say, very emphatically, that I do not like them. I bought from the dealer a set, with sockets to match, all fitted. He said "everybody who had them liked them," and my neighbor, who had always used them, liked them certainly. I remember that Chordal, a year and a half ago, told what was the matter with them, but I had forgotten what, and said as much. He replied, "Chordal is a humbug." I knew better, but acted as if I did not, and allowed myself to be persuaded into ordering a set of taper shank drills; but I am not happy. It may not be the fault of the taper shank, however, but the job. The shanks are in many cases too small for the drills, and the flats too small for the shanks. The flats twist like a screw, or twist off, and that twists out the hole in the socket, and the two twist the drill loose when it begins to go through the work, and the thing ends up badly. If you want to use a boring bar, it wriggles loose or twists off the stem; and if you want to face a boss on the underside of a piece, "it is not in the pins." I do not like the taper-shank drill system because of the difficulty of fitting special tools to the machine; I do not like them because I have invented a drill chuck, and it is my province to ridicule all other devices. The taper shank won't stick when you want it to, and will stick when you don't want it to, and then it takes a drift and a hammer, or a monkey-wrench, or a mandrel, or a block of wood, or a chunk of iron and three hands to get it out.

The parallel shank with a flat on one side is the thing, when the set screw does not bruise the flat, and when the other fellow does not put in the drill wrong side to, and bruise it so it won't come out, and when the set screw does not come in the way so you cannot drill up in a corner, and when the set screw does not catch you in the sleeve and wind you up, or when the boys do not carry off the wrench—that is to say, when neither or all of these things occur, which is not often, the set screw plan is just the thing, providing the drill does not wobble.

Fig. 11 shows a chuck that may suit some who neither fancy the taper shank, nor stand by the old set screw. The drill shanks, as is to be seen, are to be parallel, with a flat on one side, the same as for the set screw. A wedge takes the place of the set screw and is tightened by the knurled nut that is operated by hand. The drill cannot be put into the chuck until flatted on one side, and that side put next the wedge. Striking up the drill, as is usual with the taper shank sort, makes it fast as the wedge is driven up with it, and an extra turn on the nut binds it fast. Unscrewing the nut forces out the drill. The cheapest kind of drill shank is used, there is no set screw in the way, and no wrench or drift required to operate it. There is no possibility of the drills turning, and the grip is superior to the Beach style because the taper of the wedge is very slight.

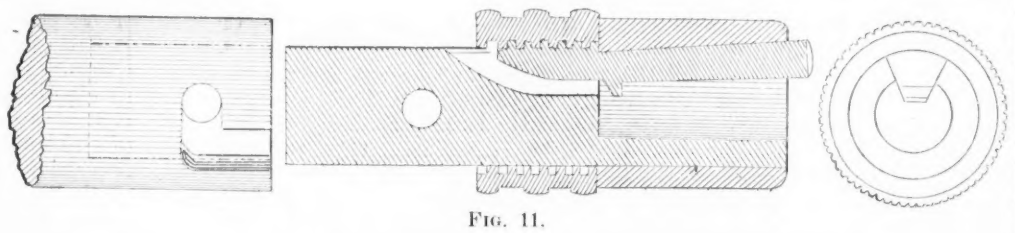
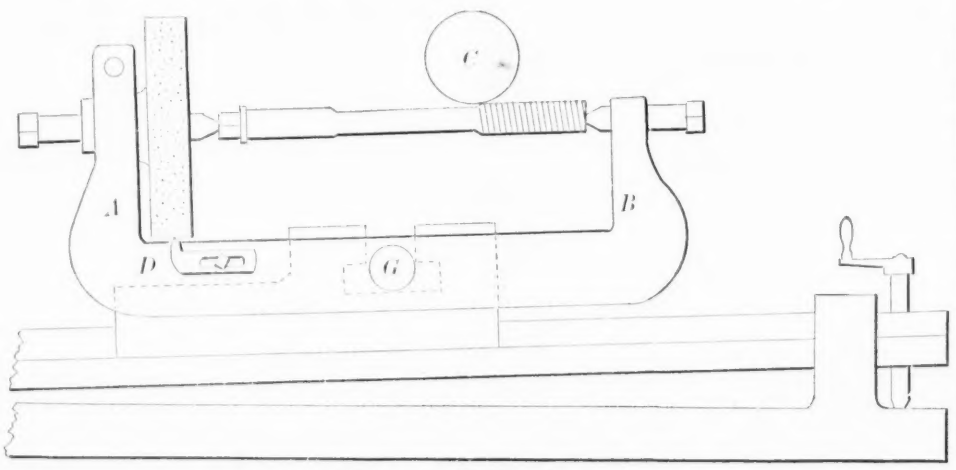


FIG. 11.

* * * * * *

The best way to fasten a chuck to a drill spindle is, I think, the bayonet joint. I have tried it made in this way. A thread was cut on the spindle of the drilling machine to correspond with the thread on our lathes, and the chucks made to fit. The thread on the spindle was then divided into four equal parts vertically, and each alternate quarter cut completely away. The chucks were then screwed on tight, and the marks transferred, and corresponding quarters of the thread cut out of the chucks. To put them on, it was only necessary to slide them up and give a quarter turn; and to remove them, give a quarter turn back, and they would fall off.



PLAN FOR FLUTING TAPS.

A better plan would be to cut a double thread, and then cut out the alternate quarters in the same way. It would not then be necessary to look for the right position before putting the chuck on.

A pin through the spindle, with the old lantern bottom notches, would probably be the cheaper and better way, or still better, the method shown in the cut; for by this method the cost of the chuck is less than if the socket were outside. It is not certain that either this drill chuck or the method of putting it on is new—very likely not.

In fact, I begin to despair of ever getting up anything new. It was very foolish in me to let you publish the view of the Straight Line Engine. It was premature, and I had allowed myself to float into a belief that there was really something new about it, but the publicity your notice gave the subject has dispelled all such idle fancies. I had thought myself pretty well posted as to what was going on in the world, but, to my surprise, there appear to be more straight line engine builders than I supposed there were engine builders of all kinds put together, and more straight line engines in the world than all other sorts. The news of their existence and wonderful achievements roll in from all over the country; from Canada, from England, and from Continental Europe. I will not trouble you with these reports; still it is but right to notice, even at this late day, Messrs. Skinner & Wood's courteous and complimentary note published some weeks ago in your paper. By an examination of their plans, which they had the kindness to forward, I see they have a frame with two arms straight in one direction and level with the center of shaft and cylinder; the structure resting on three supports, apparently bolted to a casting as strong as the frame itself, in the place of my three self-adjusting points of support, resting on the floor. But their frame, instead of being straight in the other direction, is parallel for the length of the guides, and then each arm branches out in an O. G. curve to get to the main bearings. Now, I do not object to this frame as a mechanical construction. I do not object to their calling it a "straight line," if they want to—in fact, I will go farther, and admit that it is an improvement over mine in this: that if a man like myself, advocating the straight-line principle comes along, they can take him one side and say: "There, Mister, if you want a straight-line engine, here you are!" And then, again, if Mr. Chordal comes along, they can lead him up to look at the engine, as they would to look at a corpse in a coffin, and say: "There, Mr. Chordal, speaking about the 'flowing lines of grace,' we think they are here."

The Fitchburgh Railroad shop has lately put in a sand blast for recutting files.

Letters from Practical Men.

FLUTING TAPS ON A LATHE.

Editor American Machinist:

Many country shops do not have that useful tool—the milling machine, so that the workmen have to devise ways and means for doing an occasional job.

Here is one of those plans for fluting taps, etc., on a common lathe.

The construction is very simple: Take a piece of common flat bar iron $\frac{5}{8}$"x1$\frac{3}{4}$", and about 14" long more or less. Flatten the ends edgewise, and turn them up about 3" as shown in the cut. A pointed screw in each end, and a bolt hole, *G*, near the center to secure it to the tool block, complete the rig.

The cut explains itself. Both ends may be shaped like *B*, or the end *A*, may be enlarged to receive the hub of a small index plate, in which case the range of work will be greater.

Nuts may be slabbed, burrs and reamers milled, and small gears cut with ease.

The cutter *C*, is supposed to be on a mandril on the lathe centers, and some simple catch for the index at *D*.

GEO. THOMPSON.

Keeseville, N. Y.

TIME TICKETS.

Editor American Machinist:

In your issue of July 10th, page 7, I notice the plan adopted by the Miller Co. to avoid the "terrors" of pay day. What your correspondent says about "real and fancied mistakes" in the men's pay, and "nine times out of ten finding their mistakes in their own figuring," is just true. These difficulties in settling with workmen, especially in large manufacturing establishments, necessitate the invention of methods to greatly reduce or wholly remove this worry. I presume every time-keeper and pay-master would rather have a little more deliberate labor previously than the annoyances of pay day.

Your correspondent has given us a good plan, but I will herewith submit my plan, adopted in the latter part of last year, which is giving excellent satisfaction.

Each workman is furnished, by his foreman, with a blank like that inclosed:

These tickets are printed three on a sheet, and will last three weeks. We work about 225 men on the "Eclipse" engines and sawmills, and, since they are trained to it, each man hands in his ticket to his foreman on Monday for the previous week's work. Each foreman keeps a daily record of his men's lost time, and after comparing the tickets and tracing up errors (which are few), the tickets are put in my possession. I have, then, the records of the workmen and the foremen. In addition to this, I keep a daily office record. I go to each foreman every day toward evening, and he reports who has lost time and how much on that day. Every week I compare the time tickets with my record, and this is final. On my record, or pay roll, I add the time for each week in hours, and place the number in the space left vacant by the Sundays. These spaces can be made prominent by ruling the side lines with a different ink. At the close of the month the weekly amounts are added, as a monthly total of time made, and few errors are discovered.

We have two pay days per month; on the 20th, when we pay even fives, tens, or twenties. Then on the 8th of the succeeding month we pay the balance (for the previous month only), except the cents, which are carried forward as a balance to each workman. All money is put in small manilla envelopes, which are separated to each department, and arranged alphabetically. Within half an hour of quitting time, I can easily hand over to each man his pay, without interrupting his work, thus avoiding all confusion and and delay. With us, this system works so well, that we think it is not susceptible of very much advantageous improvement.

Yours truly, D. B. MENTZER.

Accountant with Frick & Co., Waynesboro, Pa.

TIME TICKET.

HAND IN SURE ON MONDAY MORNING.

My Account of Labor for Frick & Co.,
For the Week Ending ..... 1880.

Regular Time—Days..	Monday	Tuesday	Wednes'y	Thursday	Friday	Saturday	Total
Date.							
Hours Made.							
Overtime Hours.							

Respectfully submitted, subject to corrections.

(SIGNED),

N. B.—Business with the office must be done through the Foreman of your department.

INSTRUCTIONS TO ENGINEERS AND BOILER ATTENDANTS.

Editor American Machinist:

In your issue of July 24th you do not agree with the Manchester (England) Steam Users' Association on firing. Their instructions are to keep the grate bars covered right up to the bridge. Now, Mr. Editor, I think that it is best to keep the grate bars covered all over, even from the fire doors right on to the bridge, and this, I think, is what the Association meant.

It is not a very easy matter for a fireman in England to throw his coal up to the bridge, for the grates are commonly about 10 feet long; fire doors 12 inches high, and the boiler only 16 inches above the grate at the bridge. It will not do to throw the coal as far as he can, but he should see that the grate is covered right on to the bridge.

In regard to turning on feed into a hot boiler and drawing the fire being dangerous, you certainly must be right.

I have had considerable firing to do, myself. I ran the engine and fired the boiler in a mill not a hundred miles from Denver, where they burned 4 cords of wood every 12 hours, for more than a year, in a thirty horse-power boiler of locomotive form. The engine was horizontal with 12½ inch cylinder and 30 inch stroke, running 80 revolutions per minute. It was necessary to keep the blower on continually to burn all that wood. So the first time the engine stopped on my shift, I turned the eccentric cam ahead about 22 degrees on the shaft, which stopped the blower, and reduced the consumption of wood to 1¾ cords per 12 hours. I moved it ahead a little more, after that, and the wood consumed since, is about 1½ cords. I never had an opportunity to take off the steam chest cover while I was there.

That engine used to be heard discharging for miles around, something like a boiler bursting every minute; now it can scarcely be heard. I am from the other side of the water myself, and I hope by the saving of that wood and labor to atone in some degree for the heavy firing of my trans-atlantic neighbor.

Yours respectfully,

Jas. C. Griffiths.

Leadville, Col.,
July 22, 1880.

Apprentice Papers.

BY CHORDAL.

INTRODUCTION.

The following series of papers on natural philosophy is intended to be of use to a class of people who find, somewhat late in life, that they have neglected something. A vocation in life may be chosen, and in a few years one may find that he could be remarkably successful in that occupation, were it not for his ignorance of the laws which he finds himself compelled to yield to. Few, under such circumstances, can enter on a systematic course of study, and it is thought that the chapters here presented can furnish some useful information, without the effort of dutiful research and study. Among apprentices in the shop, the author has noticed a large percentage hungry for knowledge of the matters here treated. These boys, in many cases, are without common education, and their future success may depend on their ability to reason truth out of the vague fallacies of shop philosophy. The average text book on physics seems to have been prepared especially as an accompaniment to other branches of study, and, in many cases, they seem to have been prepared simply as a means for defining to an educated instructor a course of personal explanations to the students. The ambitious apprentice, thirsty for knowledge, gets little benefit from these books which bear constant evidence of having been prepared for another class.

It is hoped that the boys in the shop will find something interesting in these papers, and thus see that science is, after all, a something which they deal with every day, instead of the far off dreamy nothing they are wont to think it.

Those who find nothing new and instructive in these papers, are informed that they are written for others, and the critic is denied the exercise of his functions, unless he can establish that he understands the plan of the author, and is as well acquainted as he with the receptive qualities of the class for which these papers are written.

I.

GENERAL PROPERTIES OF MATTER.

Matter is the term applied to everything which has size, substance or weight. All matter is composed of very small particles held closely together. These small particles are called *Molecules*, and the attractive force which holds them together is called *cohesion*. The molecules are composed of still smaller particles which are called *atoms*.

We can take almost any substance and break it up by some means and reduce the mass to fine powder. However fine this powder may be, we may still continue to break up each little particle into still smaller pieces. There seems to be no limit to the divisibility of matter, but science tells us that there is a stopping point somewhere; that there is a point in the division of matter where the particle is no longer composed of separate particles, and cannot therefore be further divided or separated. The term atom applies to these last indivisible particles of matter. Their size is inconceivably small, and their real separation may be considered a practical impossibility.

The division of matter is an every-day process in the arts. The mechanical process of dividing matter is illustrated in all kinds of powdering and grinding. A grain of wheat is a single piece of matter, but the act of grinding breaks the grain into two pieces, then breaks these pieces, and thus by successive stages divides each piece again and again until the single grain of wheat is reduced to a fine powder composed of countless thousands of pieces, which may even be further divided into still smaller pieces. Science tells us that each of these minute pieces is composed of countless atoms, and that when the division has reduced the mass to atoms no further division can take place.

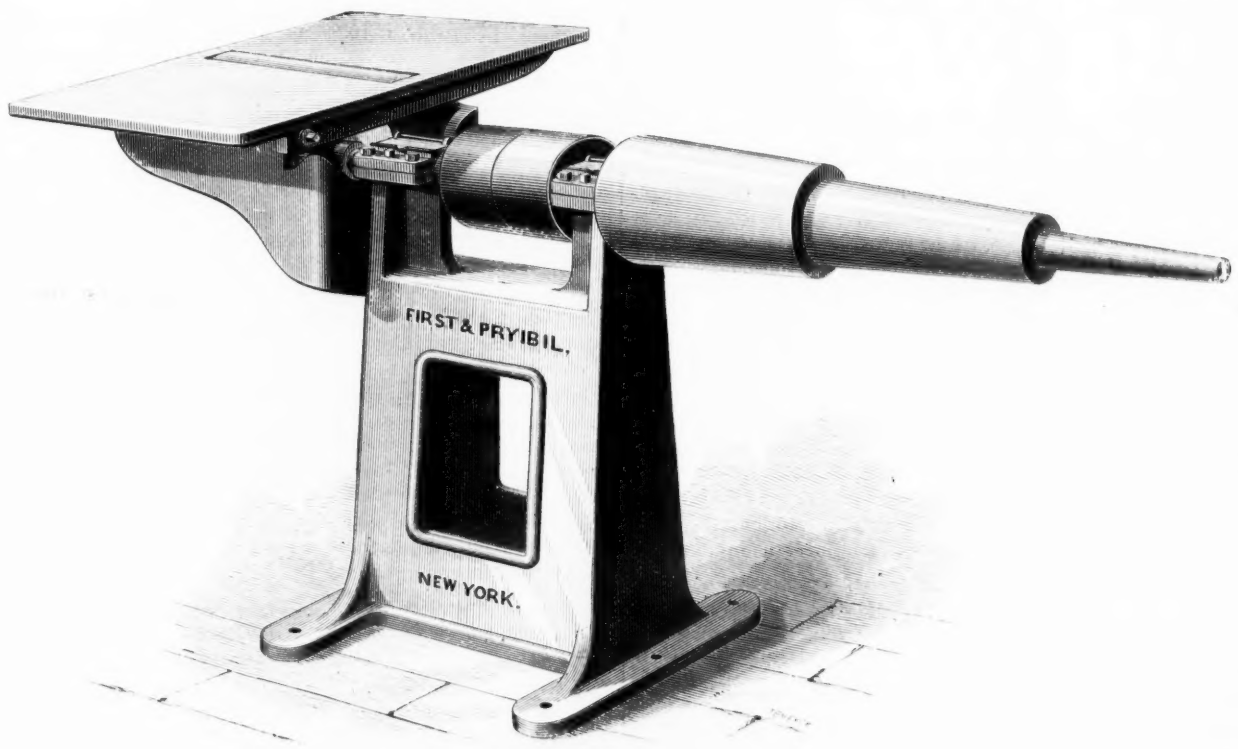
We can now understand that there is no such thing as breaking matter. Instead of being broken, the separate particles are simply separated. What we say of the grain of wheat we may say of all masses of matter.

Another method of dividing masses of matter is by solution. If a piece of indigo, the size of a pin head, be put into a gallon of water, the indigo will break up into such very fine particles that each little drop of water in the gallon will be found to contain one or more of them, and each drop will receive a blue tinge. There are half a million drops of water in a gallon, and we thus see that our trifling piece of indigo has been divided into at least that many pieces. As fine as this division is, the particles are still visible to the naked eye, which accounts for the blue tinge of the water. If we pour this gallon of blue water into ninety gallons more, we have fifty million drops of water each containing one or more particles of the indigo. The blue tinge will then be too delicate to observe, but the subdivision of the indigo into smaller pieces can be carried very much farther still.

Evaporation is still another method of dividing matter. A minute quantity of musk, or other similar perfume, will separate into particles so small and numerous that every cubic inch of air in a large room will be perfumed by it. The air in the room may be replaced by fresh air continually, but this one little mass of musk will throw off particles enough to perfume this changing air for years. The number of particles into which the musk has thus been divided is past all conceiving.

All substances are composed of atoms, but these atoms do not touch each other. Around and among the atoms there lies a delicate subtile fluid called *ether*. The space occupied by this ether is very much greater than the space occupied by the atoms. The spaces between atoms are called *pores*, and all substances are more or less porous. In some substances there are large visible pores, large enough to admit common air which is itself like all other matter made up of atoms separated by ether. We can see no pores in close grained iron or close grained wood, or lead, or mercury, or in some hard clay ware, but in cork, and sponge, and some kinds of wood, and in some very open kinds of iron the pores are large and visible. If a cylinder be cast of great strength, of the closest iron, and a piston be fitted tightly to it, and water be put into the cylinder, and immense pressure applied to the piston, water will find its way through the pores of the metal, and will ooze in fine sweat from the outside. There are some substances which it seems hard to believe to be porous, such as glass, for instance, but science has determined that the pores form the bulk of all substances. In many substances the presence of pores and their great volume can be easily shown. A brick will hold a large amount of water and be no larger. The water simply enters the large pores. If a brick be powdered up very fine so that its particles can be packed very close together, it will be found that there is very little of it; and it will also be found that the water which a brick will hold has a great deal more bulk than this closely packed brick. A sponge is another illustration. Liquids have pores like all other substances. Liquids are made up of little atoms and larger pores, and the atoms and pores in different liquids are of different sizes. In some liquids the pores are large enough to admit the atoms of other liquids. In this case it will be seen that a liquid may actually hold more liquid without increasing in bulk. It would be, in some degree, like pouring water into sand. A gallon of water and a gallon of sand mixed, will not make anything like two gallons of the mixture.

In the same way, strange as it might seem before the matter was somewhat understood, a gallon of water and a gallon of alcohol mixed, will not make two gallons of mixture.



Improved Sand Papering Machine.

Improved Sand Papering Machine.

This machine is designed for all kinds of work in which sand papering is required, such as the manufacture of plain and sweep furniture, parlor frames, chairs, pianos and for carpenter's use. As will be seen by the cut, the sand paper is placed on iron conical drums, which are lined with rubber, so as to produce elasticity.

In using sand paper on drums, every grain must do its work; when sand paper is placed on disks or flanges, as has hitherto been commonly done, the lesser grains were not utilized at all. The machine is constructed entirely of iron, and has drums of different sizes, suitable for almost any kind of work. The largest has a slotted movable table, and is principally used for straight work.

The sand paper is cut after a template, the edges joined, and when drawn over the drums, fits closely, like a glove. The conical shape of the drums prevents the paper from slipping, and does away with the use of glue. The loose and tight pulleys are 8x4 inches in size with a speed of from 750 to 800 revolutions. It is manufactured by P. Pryibil, 461–467 West 40th street, New York city.

An improved method of stopping engines, says the *Electrician*, has been devised by Mr. James Tate. The main object of the device is to enable any child or unskilled person, in any part of a mill, to stop the engine in case of an accident. The action is exceedingly simple. By touching a spring similar to the spring of an electric bell, an electric ball is set in motion, and the ball drops and shuts one of the valves, which prevents the steam from escaping, and the engine is brought to a stand-still.

The Newton (Mass.) *Republican* says: The fasting Dr. Tanner has demonstrated that a man can live without food. There are thousands of young men in this country who have already demonstrated that a man can live without work; so it only needs to be proven that sleep is another useless habit, to convince mankind that it would have been just as well if the first parents had died without issue.

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Location of Factories.

One of the most important points to be settled in any manufacturing business is the proper location of the works. Very frequently this essential matter is made secondary to the procuring of capital, or the formation of the firm or company. From being one of the chief foundation stones in the business structure of the establishment, it becomes a matter of apparently unimportant detail.

To illustrate one of the phases of the case: Messrs. Smith & Jones are thorough-bred mechanics, and given proper facilities for manufacture and handling, have the knowledge necessary to enable them to compete with anybody making goods in their line. But, in order to do business on the scale that they desired, they considered it essential to induce Brown to join them with a handsome quantity of ducats. Like Barkis, thrifty Mr. Brown was willing, but, unlike Barkis, he was willing upon conditions. Brown is the opulent proprietor of an A 1 hotel in the city, which turns out a nice fortune every year. One summer Brown took a notion to become a gentleman farmer, and purchased a beautiful farm of 600 acres, with a beautiful old-time mansion and a neat running stream on it; the farm was located about thirty miles from the city and three miles from the nearest railroad station. The idea of the firm of Smith, Jones & Brown being suggested to him, it occurred to Brown that it would be a nice venture to locate the works on his newly-purchased country premises. Of course houses for the workmen to live in would have to be built, and this Brown had no objection to doing, provided he could secure a handsome interest on his money by way of rent collected from the men, the Company, of course, holding itself in readiness to guarantee the rent by withholding wages whenever necessary.

Also teams must be provided to carry materials, manufactured goods and samples to and from the railroad station, with a neat rig to carry passengers.

The arrangement being decided upon, the necessary water-power facilities were put in hand, and a number of workmen were engaged; meanwhile half a dozen double-frame houses were built for the men and half a dozen more talked of. In honor of Brown, the embryo village thus brought into being was called Brownsville, and Brown felt correspondingly complimented. After a few months' preparation, aggravated by any number of delays, things came to a focus and the factory got to work. All the machinery and supplies required, as well as all building materials, of course, had to be brought from outside, and hauled over the three mile jog between the railroad and factory. Through somebody's blunder, some of these things had either been made wrong or ordered wrong, and some had consequently to be sent back to the makers, while others were altered and tinkered up on the premises under some disadvantages and at considerable expense. Naturally, the team expenses between the village and railway were pretty steep also, but this item of expense went to Brown's credit with the firm, and of course he made no complaint. While the houses were building, the workmen employed in the factory were obliged to board at the neighboring farm-houses, anywhere from one to three miles away. After the half dozen houses were completed and while the others were merely talked of, such of the workmen as could not find accommodation in them were obliged to continue this interesting practice, leaving their families in the city, or wherever they were able. Most of these men naturally desired each week to spend Sunday with their families, and Saturday and Monday working hours were correspondingly shortened, to the frequent inconvenience of the firm. Once or twice, the employers in the busy season ventured to object to these awkward furloughs, and, as a result, the workmen thus deprived of their family privileges gave up their jobs. On this plan, a good many married workmen of the comfortable sort, declined to work in a place where their families could not find a home, and it was noticeable that these were always the best men. But the firm could not afford to turn one good workman out, merely for the sake of letting another in.

Naturally, too, the younger workmen found life in Brownsville considerably slower than they had been accustomed to in the towns and cities where they had formerly worked, and some of the best of them declined to remain longer.

The result of all these complications, in the matter of workmen, was, that the firm found it much easier to keep poor workmen than good, the constant tendency of their force being to degenerate into a mob, composed of a few good married men, and a swarm of half-fledged boys working on higher wages than the firm felt they could afford to pay. But the men required some inducement to live in such an out-of-the-way, unattractive spot as Brownsville.

Putting on an additional force, when trade was brisk, also, the firm found to be an exceedingly difficult affair. New men that were worth having, could not be conveniently obtained, for the reasons already outlined, while in dull times, the firm found it equally undesirable to let any of their men go. Married men, who had been induced to come from a distance and settle with their families, at an expense which they could ill afford, could not be discharged when trade was dull, without the grossest injustice. And this being the only manufacturing establishment in the neighborhood, of course the men could not find employment elsewhere in Brownsville. As a result, Smith, Jones & Brown found themselves obliged to choose, at such times, between letting men go whose places they might not be able to fill satisfactorily, when they should desire to do so, and continuing to pile up goods that they could not sell, made by workmen who were not needed, out of materials bought at inconvenient times, and often at unfavorable prices.

The relations between the works and the office which the firm were obliged to establish in the city, and the consequent necessity of carrying double stocks, the taking of orders at the office which the factory were unable to fill at the time specified, and the annoyances resulting therefrom, were also aspects of the Smith, Jones & Brown case, which might be mentioned, but the foregoing will serve to show one of the causes, which for some years operated to place the balance on the wrong side of the ledger.

One week ago to-day we wrote that the attempt to recover the bodies lost in the Hudson River Tunnel disaster by constructing a coffer dam, instead of either a water-tight crib or an air-tight caisson, was a gigantic blunder, that would fail of its object and cause long delay. To-day the morning newspapers announce that the engineers in charge decided on *yesterday* to begin the construction of a caisson! Better late than never.

Steam Pilot Boats.

From the agitation now going on regarding the steam pilot boat question in the waters of New York Bay and vicinity, it might be thought that progress was the exception and conservatism the rule in this country. The argument that the greater number of pilots employed under the sail-boat system affords greater economic advantages than the employment of fewer men and swifter boats, would seem to indicate that a still greater economy of service might be gained by scattering a greater number of men in row-boats over a greater expanse of water. The argument is trivial, in the face of the fact that good pilots would be glad to serve the interests of commerce by manning steam pilot boats, if permitted to do so. The fact is, the present pilotage system is a monopoly, and monopolists naturally oppose any change which promises to interfere with their interests. The authorities should remember the year in which we are living, and try again.

Chordal's Apprentice Papers.

In this issue we begin the publication of a series of articles from the pen of our valued contributor "Chordal," addressed to a class of readers whose welfare lies so near the heart of the author, that we feel sure his work will be appreciated by them. One of the prime secrets of the success of the Chordal's Letters is found in the spirit of intense helpfulness that animates every motion of the writer's pen. These papers will appear as frequently as the crowded condition of our columns and the needful diversity of subjects treated will permit.

Capt. Ericsson's new caloric pumping engine, which was first introduced to the public in the June 19th issue of the AMERICAN MACHINIST, has since gone the rounds of the American press, and now turns up in the July 24th issue of the bright English journal *Design and Work*, the engraving having been copied by photo-process. This latest child of the old engineer's brain has met with a reception that must be extremely gratifying to him. In presenting to the public, however, such a contribution to the arts of peace, the still fiery veteran must miss something of the joy that filled his breast, when the first monitor was launched, and no man but himself dared stand upon her deck during the launching.

The Cincinnati Steam Engine Test a Fizzle.

Notwithstanding months of expensive preparation, the above is a lamentable fact. Five well-known engines were placed in position at the Millers' Exhibition, but one break-down after another occurred in the auxiliary arrangements of the test, bringing up the cost of the preparations to a figure several thousand dollars higher than the estimates of the managers, and frittering away three weeks' time out of the four on the test of but *one* of the five engines. The builders of the others, naturally enough, did not feel happy over the prospect of having their tests crowded into the few remaining days, while the disgusted managers refused to extend the allotted time a single day.

The matter of load, too, seemed a difficult thing to settle. That proposed in the original prospectus was not adhered to, to the dissatisfaction of some of the exhibitors, resulting in emphatic protest and withdrawal.

Locating the responsibility of such a needless and injurious fiasco, as, between the exhibition managers and the experts employed for the purposes of the test, would be a task more invidious than interesting. It is barely possible, however, that some of the executive energy, which found expression in elaborate uniforms and badges, on the part of some of the experts, together with the display of their pictures in the windows of stores and offices about town (after the fashion of the young American ladies with Italianized names who supply us with opera music) might have been devoted to more practical uses. As it is, the promised test has not been made, the public have been disappointed, and the exhibitors have had their labor and expense for their sole reward, to the injury of mechanical progress. It is to be hoped the exhibitors will fall into line for the great exhibition to be held in this city in 1883, with enthusiasm and more pointed results.

A correspondent writes expressing a strong desire to visit Newton's shop, as described in "Extracts from Chordal's Letters," published in the AMERICAN MACHINIST of last week. He wants to know where he can find it, and encloses a self-addressed postal card. We confess we are ourselves somewhat in the dark as to the exact location of Newton's premises. The nearest guess we can make is that it may be located somewhere near the S.E. corner of Chordal's brain. Should we succeed in obtaining more precise information, we shall take pleasure in informing our inquiring friend.

Census of Manufacturing Industries.

Hitherto, the sub-officers of the census, known as "marshals," have, at the time of getting the list of inhabitants, taken also the statistics of all the industries throughout the United States; but the wonderful growth of our manufactures during the last ten years, has induced the Government to appoint special experts, to ascertain more exact facts in the larger cities and important manufacturing districts. The statistics of places having less than 8,000 inhabitants are still taken by the regular census officials, except in cases where smaller towns have very extensive manufactures.

Mr. Charles E. Hill, chief special agent for New York City (located in the Coal and Iron Exchange), has kindly informed us that every effort is being made to obtain a strictly reliable and accurate report of every industry in this city. He has a large force of special assistants selected with reference to their abilities in certain lines. Thus, a practical printer is appointed to take all the facts relating to printing and publishing, and so on, for all the separate classes. But each one of these experts is also required to report the *existence of all* manufactures in his district, and this affords a valuable check on all the other officers, which, combined with the other checks furnished by directories and Government offices, renders it well nigh impossible to omit, in the final report, a single industry.

These statistics are for the year ending May 31, 1880.

The questions asked are very full, including, among others, the following:

What is capital invested in business?

Average number of hands employed?

Wages and hours of labor?

Months in operation?

Value of material, including mill supplies and fuel?

Value of product? Power used; if water, on what stream; if steam, how many engines and boilers?

These questions belong to the *general* schedules; but there are special blanks prepared for certain classes of manufacturers; such, for example, as that of agricultural implements, on which appear over eighty questions; the ordinary blanks having from thirty to sixty questions, according to the importance of the industry.

The reports concerning the reticence of proprietors in furnishing correct returns, seem to be groundless, for Mr. Hill says that almost the only drawback to his work is pressure of business on the part of manufacturers. In very few cases, and these mostly in small lines, is it necessary even to inform the parties that, by the late census law, they are *compelled* to give the desired information; for, usually, the intelligent classes see that it is for the interest of all that these reports should be full and correct.

It is of the greatest importance that the information should be quickly given, for, while a half hour makes but little difference to each individual, it aggregates a great delay for the government in gathering the returns.

As for the secrets of business being divulged, it would not only be bad political economy in the Government, but would involve useless expense. The sum total is in every case all that is possible to be made public, as every official, high or low, is sworn to absolute secrecy.

The only objection to the workings of this system of census-taking that suggests itself, is the possibility of omitting (on the part of the regular census-takers in certain villages and districts) to compile this class of statistics, owing to their expecting the special census agents to include these places in their returns. Further, only a slight degree of careless haste, in comparing such statistics, taken in detail by separate agents acting under different systems, would be required to produce misleading duplications, that would tend to make the country believe itself considerably more prosperous than it really is. It is to be hoped that all possible precautions will be observed in this direction.

The branch of census-taking, over which Mr. Hill presides, differs from that which we have previously described as under the direction of Prof. Wm. P. Trowbridge, of Columbia College, New York, in that the latter takes account of the tools and machinery by which manufacturing results are reached. Mr. Hill's work consists in tabulating these results for this city.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) H. H. T., Brocton, Mass., asks: Given, a 2 ft. pulley at 195 revolutions per minute belted to a 2 ft. pulley, 6 ft. distant, by a 6″ common leather belt—What is the horse power transmitted? Also, how much will a 7 in. belt increase the power? *A.*—There can be no general rule applied for determining the horse power transmitted by leather belts, in consequence of the greatly varying circumstances and situation. The following italics, however, embody a rule, which has been used by an old engineer and machinist of extensive experience in measuring power. *A belt running at a velocity of 600 feet per minute will transmit one horse power per 1 inch of width.* We will assume, as a safe working strain, 330 lbs. per square inch, or 55 lbs. for a thickness of 1-6 in. The velocity and width being given to get the horse power. *Divide the actual velocity by the velocity per horse power* (600 *feet*) *and multiply by the width.* In this case we have a velocity of 1225 feet per minute, which is found by multiplying the circumference of the pulley by the number of revolutions per minute. We then divide 1225 by 600 and multiplying the quotient 2 by the width of the belt, which is 6″, and get the following result:

$$\frac{1225}{600}=2\times6=12 \text{ H. P.}$$

For a belt 7″ wide we get the following:

$$\frac{1225}{600}=2\times7=14 \text{ H. P.}$$

(2) J. T., Connersville, Ind., writes: Seeing my question partly answered in your issue of July 24, 1880, in regard to the quivering of our boiler, at your request I send a sketch of boiler and setting. The supply pipe and safety valve are both connected with the same stand. The supply pipe is 2½″ diameter, is 14 feet long, and has three elbows. The engine sets 6 feet below the bottom of the boiler. We put a temporary stand under the extreme back end which seems to help it some, but did not altogether stop the quivering in supply pipe and boiler. The fire line strikes the top flues two-thirds the way up. Is that right? The engine is 12″ x 20″, and runs at 165 revolutions per minute and cuts off at two-thirds stroke. Boiler is clean and in good condition, and has been in use about six years. Will the quivering injure the boiler? *A.*—The trouble is in the boiler setting, as we intimated in our previous answer.

Note.—*The boiler shown in the sketch sent represents a cylinder boiler 42″ diameter and 18 feet long. One end rests upon the boiler front, while the other end is supported by a brick stand placed at some distance from the back end.*

We never saw a boiler set in a more careless manner than the one referred to, and we do not wonder that it "quivered." The vibration is due to the boiler being improperly supported, being balanced upon two points, viz., the boiler front and the brick stand. We would advise you to place the brick stand under the end of the boiler, making it of a large size. The boiler should rest in a cast iron saddle which is at the bottom. A plate should be placed upon the top of the brick stand, and two turned rollers placed between the plates to allow the boiler to expand freely. With this style of setting a boiler has a tendency to break up the brick work, as the boiler rises and falls every time it is fired up. A far better way to set a boiler is to suspend it from two points at the top and near the ends by means of iron clips or suspension loops strongly riveted to the shell. Two bars should be placed across resting upon the brick walls. The boiler is thus relieved from the strains which would otherwise be brought upon it. Another, and quite extensively used, plan is to rivet two or three cast iron brackets upon each side of the shell. The fire line should always be at least 2″ below the lowest water level in the boiler. Vibrations are injurious to a boiler. The more quiet it can be kept, the longer it will last.

(3) F. S. B., Tiverton, R. I., writes: Some time ago I wrote you about a boiler that gave me, as well as others, considerable annoyance on account of its humming, and asked you for a remedy. You suggested a partition across the ash-pit, if there was none; in this case the ash-pit for both furnaces was in one. Since I received your answer, I have had a partition placed across the ash-pit which has stopped the humming altogether. Having succeeded so well with that question, I beg leave to ask information about another subject. Please explain to me the principle of the vacuum gauge. What I want to know is, if the air acts on the spring or tube the same as steam, or the reverse? *A.*—A steam gauge may be used as a vacuum gauge by changing the gear so as to cause the pointer to move in the opposite direction. A vacuum gauge is simply the reverse of a steam gauge. Instead of a pressure, as in the former, there is a vacuum which causes suction or a pressure in the opposite direction.

(4) C. P. Grinnell, Iowa, writes: I am turning a shaft 2″ in diameter. The foreman directs me to ascertain how many feet per minute my lathe is cutting. Shall I measure the diameter of shaft before or after turning, or midway between the two points? An answer will settle a controversy between the foreman and the writer. *A.*—We will answer this question by illustration. Suppose we have a shaft of 5″ diameter, and the lathe tool is adjusted so as to turn off ½ inch, which reduces the shaft to 4½″ in diameter. To get the number of feet turned, we take a mean circle between the top and bottom of cut, which in this case will be 4¾″. The circumference of this circle would be the same length as if the thickness of iron turned off were straightened and placed upon a planer. The number of feet cut in both cases would be the same. To get the number of feet turned per minute, multiply the circumference of the circle, referred to in inches, by the number of revolutions of the shaft per minute, and the product will be the speed in inches. This, divided by 12, will, of course, give the speed in feet.

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Messrs. Thomson, Sterne & Co., (Limited) having most extensive British and Continental connections for the products of their well known works, "The Crown Iron Works," Glasgow, offer the facilities of their works at Glasgow, and their London and Paris offices, for the introduction of American mechanical and engineering inventions in Europe. Reply to Messrs. Thomson, Sterne & Co. (Limited), The Crown Iron Works, Glasgow, Scotland.

American Watch Tool Co., Waltham, Mass. Lathes, Watch Case, and Clock-Making Machinery.

See Christiana Machine Co.'s adver., next number.

The $4 Drill Chuck, 0 to 9-16. Sent free on receipt of price. Address A. F. Cushman, Hartford, Conn.

Double Pitman Presses. Stiles & Parker Press Co., Middletown, Conn.

For Sale—A New York Steam Engine Co., 21 in. heavy slotter, in good order. Address Southwark Foundry and Machine Co., Philadelphia.

All makes and sizes of Steam Hammers bored out. L. B. Flanders Machine Works, Philadelphia, Pa.

Paper Making Machinery—Makers of above from fibrous material as wood, esparto grass, etc., send address to Joshua Rose, P. O. Box 3306, N. Y. City.

Lathes, Planers, Shapers, Drills, Bolt and Gear-Cutters, Milling Machines. Special Machinery. E. Gould & Eberhardt, Newark, N. J.

Engines, Hoisting and Pumping Machinery for Mines. The Band Friction Hoist, which is the safest, simplest, strongest and best in the market. Also, Friction Clutches. Address, Webster Camp & Lane Machine Co., Akron, O.

Rules for Engineers, and Removal of Scale in Boilers. Send for Circular. Ranken Scale Co., 50 Federal Street, Boston.

Dixon's Traction Belt Grease. Dixon's Founders' Perfect Wash. Dixon's Plumbago Foundry Facing. Dixon's Graphite Machine Grease. Dixon's Everlasting Graphite Axle Grease. Dixon's Dry American Graphite Perfect Lubricator. Send for explanatory circular to Dixon Crucible Co., Jersey City, N. J.

Wanted.—A Second-hand, 6 inch Vernier Caliper Gauge, in good order. Address J. E. Wilson, Bridgeport, Conn.

Wilkinson & Crowell, No. 506 Walnut St., Philadelphia, "Paragon" Piston-rod Packing, entirely metallic, automatic, frictionless, and practically free of steam pressure. Will work on high-speed or condensing Engines.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, D. Appleton & Co, New York, or the author, Manchester, N. H.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

John Douglass, common and fine patterns made to order, also car wheels, working models, and experimental machinery. Shop at Washburn, Hunts and Co's Wheel Foundry, cor. Warren and Bay Sts., Jersey City, N. J.

Messrs. Thomson, Sterne & Co., (Limited) of Glasgow, London and Paris, would be pleased to consider proposals for agencies in the principal cities in America, for the sale of their well known Consolidated Emery Wheels and Emery Wheel Machinery, manufactured at their Works, "The Crown Iron Works," Glasgow. The highest medal for Emery Wheels and Emery Wheel Machinery was awarded to this firm by the Jurors of the Paris and Sydney Expositions. Reply to Messrs. Thomson, Sterne & Co., (Limited), The Crown Iron Works, Glasgow, Scotland.

Manufactures.

The Morden Frog & Crossing Works, of Chicago, formerly on North Water Street, have recently erected new works for the manufacture of railroad frogs and crossings, at 68, 70 and 72 Pacific Avenue.

The new bowl factory of White & Smith, near Petosky, Mich., has commenced operations. The factory is run by steam power, and maple timber is used, principally.

The contract for the construction of a Morse cotton press, weighing about 150 tons, with a 90-inch cylinder, has just been received by the Reading, Pa., Iron Works, and work on it is to be commenced immediately at the Scott Foundry.

Messrs. Peter Gerlach & Co., manufacturers of saws, stave and barrel machinery, Cleveland, O., have received a cablegram order for three of their patent champion barrel stave sawing machines from Russia.

The Chicago Furniture Workers Association, 37 to 41 North Union St., have lately organized a co-operative establishment, and are making a specialty of artistic furniture for the trade. The stockholders number 560. Two thousand shares have been issued at $25 each, which are all taken up, and about 60 men are busily employed.

A rolling mill is to be started in Colombia, South America. Six members of the Association have left Pittsburgh for Colombia to work at it, being engaged at high wages.

It cost the citizens of Allentown, Pa., an investment of over $30,000 to induce the Phœnix Silk Manufacturing Co., to settle at that point. The investment promises to be a profitable one. The silk industry is growing rapidly in Pennsylvania.

The Eureka Silk Manufacturing Co., Canton, Mass., has been incorporated, with Jos. W. C. Searey, Pres., John A. Bowman, Treas. Capital, $200,000, in shares of $100 each.

The Knitted Carpet Lining Co., Canton, Mass., has been incorporated, with Geo. N. Sumner, Pres., Charles Sumner, Treas. Capital, $50,000, in shares of $100 each.

A new furniture factory will soon be put into operation in St. Louis, by Mr. Poetsch, late superintendent of the St. Louis Furniture Workers Association. It will be located at the corner of Salisbury and 15th Sts.

It is stated that a new chair manufacturing company will soon be in operation in St. Louis, and will occupy the large brick factory now building at the corner of Brooklyn and Second Sts.

F. C. Wells, manufacturer of the Wells Steam Pumping Engine, 116 to 122 S. Clinton St., Chicago, has just started a foundry.

Sacramento City, Cal., will soon have extensive rolling mills. The building will be 100x180 feet. The roof is to be of corrugated iron, and will have an area of 22,000 square feet. The 800 H.P. engine for the shops will be 32 by 36 inches.

The New Albany, Ind., Forge Works has received a contract to make 1,400 axles for the Terre Haute Car Manufacturing Company.

The Lake View Malleable Iron Company, represented by F. Shaw & Co., are erecting a building on the North-western Railway, between Fullerton and Clybourn Avenues, Chicago.

The silk mill in Boonton, New Jersey, has proved so successful that the proprietors are about to enlarge its capacity so as to employ about 400 hands. A large paper mill and other buildings are in course of construction in the same town; and the knife factory is to be enlarged so as to employ 80 hands.

The South Hadley Woolen Co., of South Hadley, Mass., has been incorporated for the manufacture and sale of woolen cloths. Aaron Bagg, Pres., and Charles D. Rood, Treas. Capital, $15,000, in shares of $100.

Weir Village, Mass., is about to have a nickel plating establishment.

The Farrel Foundry and Machine Company of Ansonia, Conn., have sold their interest in the Waterbury concern to E. C. Lewis, who has organized a joint stock company with a capital of $100,000.

Stein & Wallace are building an elevator, capable of holding 75,000 bushels of oats, as an addition to their oat-meal mill at Sterling, Ill., and will put in another steam kiln to increase their capacity.

A cotton mill, 500 feet long, 74 feet wide, and four stories high, is to be immediately erected on the York Corporation, Saco, Me.

A mill for the manufacture of fine cotton goods, will be built at Ipswich, Mass. It will be 280 feet long, 70 feet wide, and four stories high.

Messrs. Waggoner & Gates, proprietors of the City Mills, Independence, Mo., are building a 100,000 bushel elevator. They are also adding two more run of stone and corrugated rolls.

W. W. Tunis & Co., of Tunis, Md., have ordered a 125 H.P. Lawrence engine; cylinder, 14½×24, to make 150 revolutions per minute, with piston speed of 600 feet per minute. It has one balance wheel 6½ feet in diameter.

The Remingtons, at Ilion, N. Y., are at work on a $25,000 contract—guns for Buenos Ayres.

Smith & O'Leary, steam hammer forge works, Chicago, have recently erected a new foundry, 100 x 125 feet, where they manufacture every description of cast steel tools and castings. They melt from 1,000 to 1,500 pounds of iron per day.

The Secretary of State issued last week a license to organize the Chicago Steel Horse-shoe Company; capital, $60,000; corporators, William Bullmann, James H Etheridge, and Herman G. Powers.

The Terry Clock Co., of Pittsfield, Mass, has been incorporated, with Edward D. G. Jones, Pres., and Hezekiah S. Russell, Treas. Capital, $22,500, in shares of $100.

The Citizens Steam & Gas Light Co., of Lynn, Mass., has been incorporated, with Arthur H. Soden, Pres., and Jas. Anderson, Treas. Capital, $50,000, in shares of $100.

Elsey School Furniture Co., of Springfield, Mass., has been incorporated, with John Olmstead, Pres., and A. B. West, Treas. Capital, $10,000, in shares of $100. They will engage principally in the manufacture of "Elsey's model school desk, and improved ink well."

The Deane Steam Pump Co., Holyoke, Mass., are enlarging their works, as they have been overrun with orders. They are making a special fire pump that they claim has advantages over all other pumps, in that should the supplemental piston, which is driven by direct pressure of steam, accidentally fail to be driven by this pressure alone, then the whole power of the steam in the main cylinder is brought to bear to compel its action. The Company has just made some special fire pumps for the Southworth Paper Co., Mittineague, Mass.; Hadley Thread Co., Holyoke, Mass.; Dudley Hosiery Co., Newton Lower Falls, Mass., also a large number to go South and West.

New grist and flouring mills about to be established:—At Lenoir, Tenn., for W. B. Hope; at Jonesboro Texas, for E. T. Aiken; at Slate Lick, Pa., for D. C. Boggs; at Egan, Minn., for J. A. Van Lew, of Rushford, Minn.; near Valley City, Dak., for James Sorenson; at Springfield, Ill., for the Springfield Elevator Company; at Tecumseh, Neb., for H. W. Brandon.

Among the latest enterprises of Camden, N. J., is the Horse Tail Razor Strop Company, located at 410 Jasper Street.

The Everett Mills, Lawrence, Mass, have set eight boilers with the Jarvis furnace, and are burning screenings very successfully without a blower.

A silk mill is being erected at Hawley, Penn., which will have a ground floor of over an acre, be several stories in height, and give employment to 1,000 hands.

Machinists' and Engineers' Supplies.

NEW YORK, August 12, 1880.

The supply market, although a little more quiet this week, is in a healthy condition, and the outlook is unchanged. No changes in prices worthy of notice have occurred since our last report.

It is believed that there will be some changes in the prices of manufactured brass and copper in a few days, the character of which is not now known.

A new and superior emery cloth and sand paper manufactured by H. H. Barton, of Philadelphia, Pa., is being introduced into this market.

The Western Nail Association met in regular monthly session at Pittsburgh, Pa., Aug. 11th, and passed the following resolution:

Resolved, That this association reaffirm the card price of $3, made and adopted on the 28th ult.

The association adjourned to meet in two weeks from the date mentioned. Considerable disposition to advance the card rate was evinced, as the feeling throughout the trade is strong and healthy.

We are in receipt of a 20-page circular from John Hill, Columbus, Ga. It is devoted entirely to his lately patented lathe dogs and face plates.

James D. Foot, 78 Chambers Street, New York, has just issued a neat little pamphlet illustrating a number of machine shop tools as specialties. A Polished Head and Emery Grinder, price $5.00, is one of these. Foot's Union Metal Oil Cup, of which formerly only one size was made, is now offered in three sizes, priced per dozen, respectively, No. 1, $2.50; No. 2, $1.50; No. 3, $1.25. Foot's Surface Gauge, for machinists' use, is now made in two sizes at reduced prices.

E. P. Bullard, 14 Dey street, N. Y., has just been appointed agent for New York City and the Eastern States, for the sale of Hot Polished Shafting, manufactured by the Akron Iron Co., Akron, O.

C. B. Thompson, Bridgewater, Conn., is offering a small Pocket Scale, or Spring Balance, which will weigh from 1 ounce to 8 lbs., that many persons will find handy. Its price is 50 cents.

Iron Review.

NEW YORK, August 12, 1880.

The market generally is stronger and it is thought will rule higher. Foundry Irons are very firm and the furnaces are well sold up, and no large lots offering. Forge Irons are also strongly held, but not so much sold ahead as the foundry sorts. The bar mills are again filling up with orders, and are asking on an average fully two or three-tenths more than a month or so ago. While no one anticipates a boom it certainly looks as though prices would gradually work up and a good steady fall business ensue.

Pierson & Co., 24 Broadway, N. Y., under date of July 29, 1880, quote prices out of store as follows:

Iron Rails, $50 to $57, according to weight; Fish Plates, 2¾c. per lb.; Railway Spikes, 3c.; Bolts and Nuts, 3½c.; Common Bar Iron, 2.4c., basis from store; Refined do. 2.6c., basis; Ulster, 3.6-10c. basis; Machinery Steel, 6½c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¼c.; Norway Shapes, 6¾c; Nail Rods, 6¾c.; Sheet Iron, 3½c., basis; Angle Iron, 3¼c.; Tee Iron, 3¾c.; Band Iron, 3.4c.; Hoop Iron, 3.6c., and up according to size; Horse Shoe Iron, 3.3c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies as follows:

Flange, 5¼c.; C. H. No. 1 Shell, 4c.; Tank, 3½c.; C. No. 1, 3¾c.; Sheet, 3½c; Angles, 3½c. Boiler Tubes 45% discount from list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of August 12, 1880:

As is to be expected at this time of the year the metal market is quiet, and yet the jobbing trade is good and the demand increasing. The statistical position of Pig Tin here and abroad is unchanged and indicates higher prices. London is £90; Singapore, $28. This market, Banca, 23¾c; Malacca and Straits, 21 to 21⅜c; Australian, Billiton, English Refined, 21c; Lamb and Flag, 20½c.; Pig Lead, 4¾c; Antimony, 16½c. to 17¼c. according to brands, Spelter, "Bertha," pure, 8½c.; Western 5½c.; Silesian, 6c.; Solder, No. 1, 11½c., "Half and Half," 13c. Bismuth, $2½.

WANTED.

Wanted—By The Pratt & Whitney Co., Hartford, Conn., two first class machinists for machine forging.

Wanted—Machinists—Six strictly first-class Vise hands and Fitters accustomed to building machine tools; liberal wages paid by Niles Tool Works, Hamilton, Ohio.

Wanted.—A position as Head or Assistant Engineer, by one who thoroughly understands running, setting up and repairing Engines, Boilers, Pumps, etc. Will give best of references or pass examination in regard to capability. Will go anywhere. Am strictly temperate. Address L., Box 24, Marietta, Cobb Co., Ga.

An experienced machinery iron works Superintendent wishes to engage with reliable parties. Address, P. H. L. care AMERICAN MACHINIST office.

Wanted by a Mech. Engineer and Draughtsman, 16 years experience, situation as Superintendent or Draughtsman. Address C. R., Box 444, Worcester, Mass.

FOR SALE.

A Works completely equipped for the manufacturing of carriage axles; is well located in relation to Coal and Iron, also very accessible to market. Address

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14 Dey Street, New York.

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Mechanical Books.

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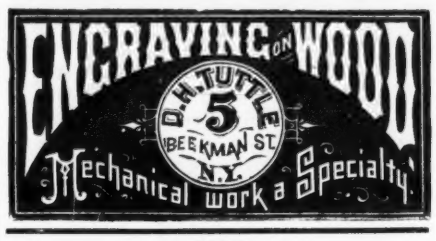
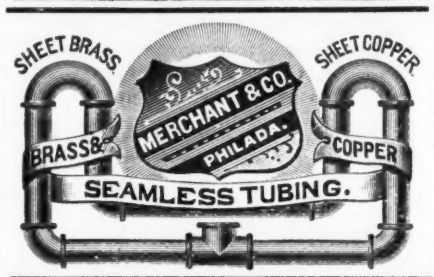
D. VAN NOSTRAND,
23 Murray & 27 Warren Sts., New York.





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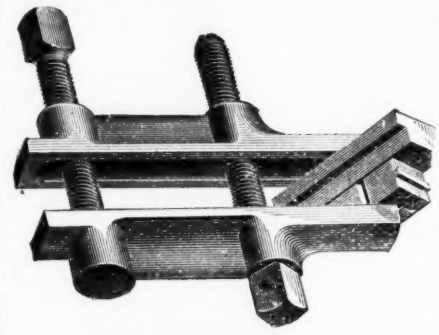
SOUTH NORWALK, CONNECTICUT,

Manufacturer of

LeCount's Vice Clamp,

With Steel Screws, hardened the whole length, a spring temper and ball head, so as to clamp an object at any angle without bending the screws. The clamps are also steel and of great strength.



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No. 1, opening 1 inch..... $1.25
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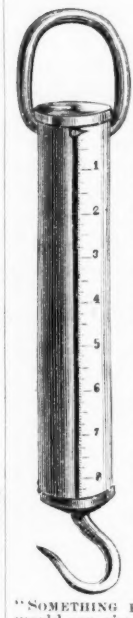

A new invention of rare merit, which must not be classed with the cheap, miserable affairs that are now flooding the country. "THE LITTLE GIANT POCKET SCALE," is a neat and useful article, which in time will throw all the old fogy scales and balances into the shade. They weigh ACCURATELY from one ounce to eight pounds. Carefully built and constructed by skillful workmen, they will give the best satisfaction wherever introduced. For beauty and workmanship they take the lead. Heavily plated with nickel silver, they cannot tarnish or rust. These scales are so small and portable that they can be easily carried in the vest pocket, and occupy no more space than a small pocket knife. (The cut or engraving represented in this advertisement is the exact size of the pocket scale). These scales are DURABLE, STRONG and ACCURATE, and with ordinary usage will last a lifetime without getting out of order, as they are built upon an entirely new principle, which the inventor spent nearly two years in perfecting. They are pronounced by NED BUNTLINE (E. Z. C. Judson), and other leading American sportsmen, to *be superior* to any scale heretofore imported from Europe, and they should be seen to be appreciated. Just the thing for Sportsmen, Trappers, Hunters, Agents, Travelers, and Family use, in fact, "SOMETHING FOR EVERYBODY." No dealer in the world can give you a scale equal to the "LITTLE GIANT" for five times the price asked. The pattern is neatly constructed and finely finished. Every Scale we send out is in perfect order and are warranted so or money refunded every time. Satisfaction guaranteed in every case. These Scales are no "CATCHPENNY" affair, but something both good and useful to every person in the land.

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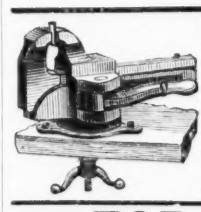
C. B. THOMPSON, Sole Manufacturer,
BRIDGEWATER, CONN.



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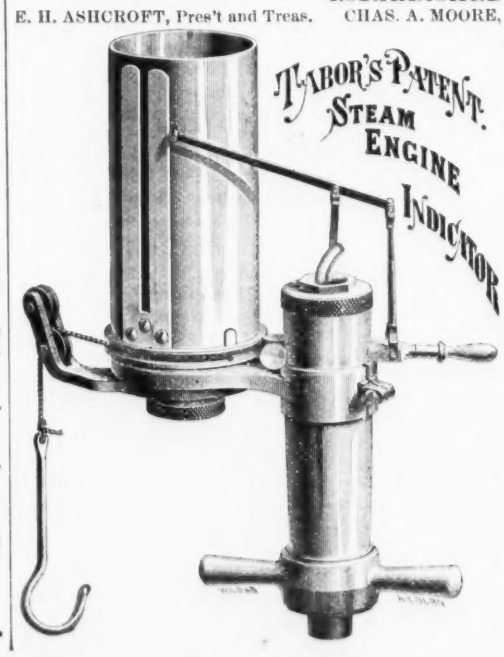

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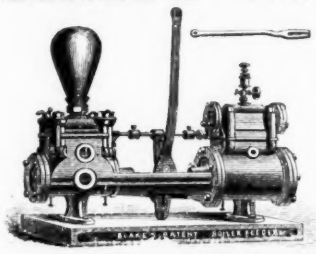

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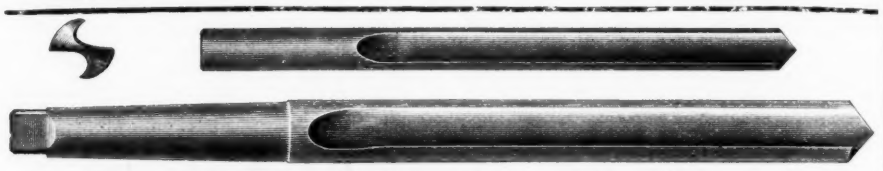

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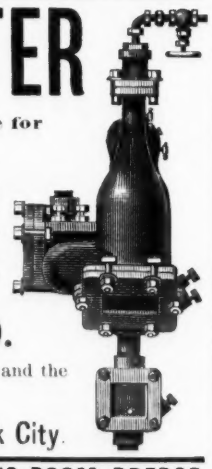

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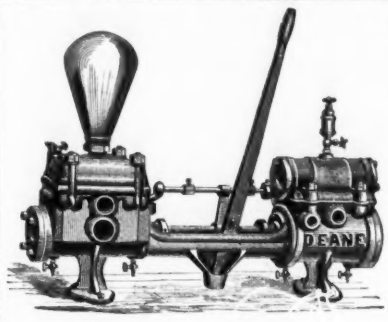

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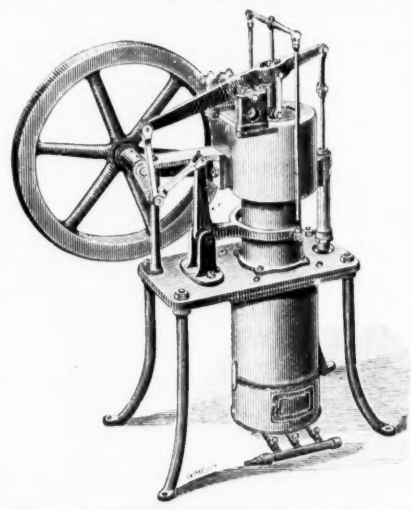

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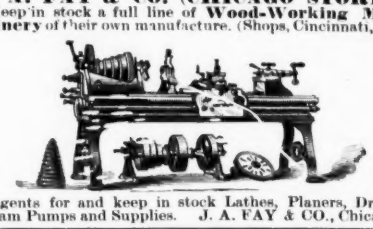

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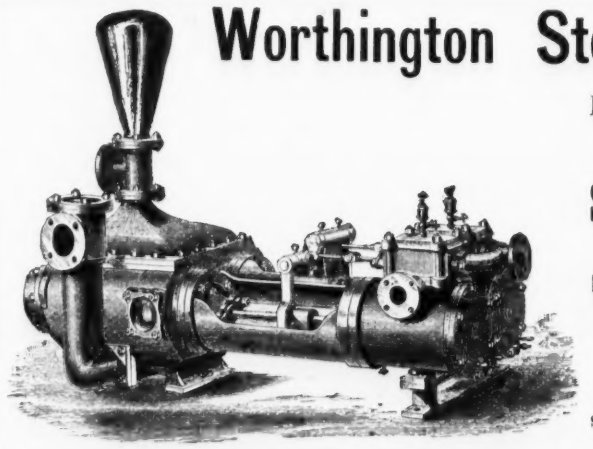

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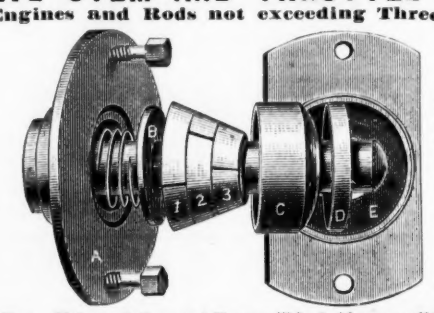

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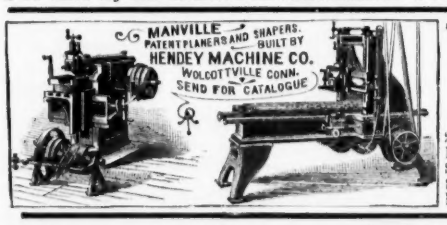

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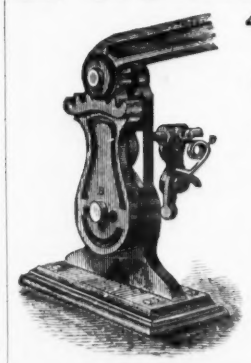

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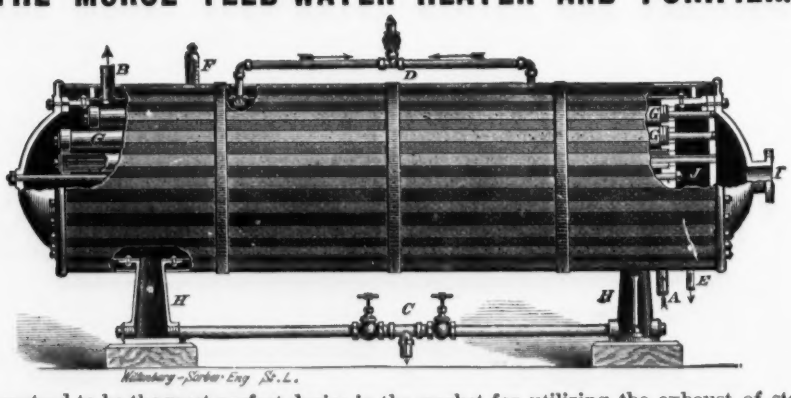

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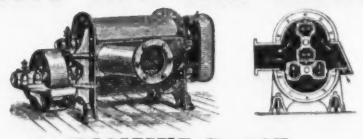

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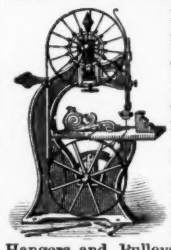

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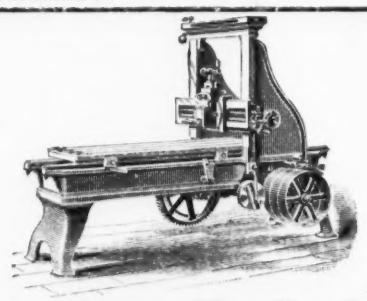

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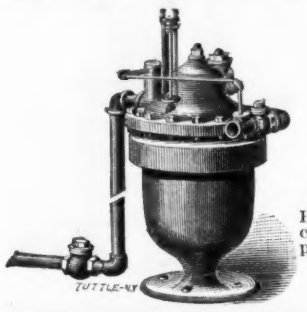

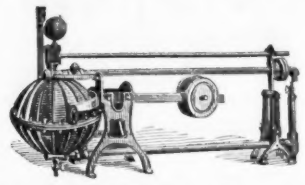

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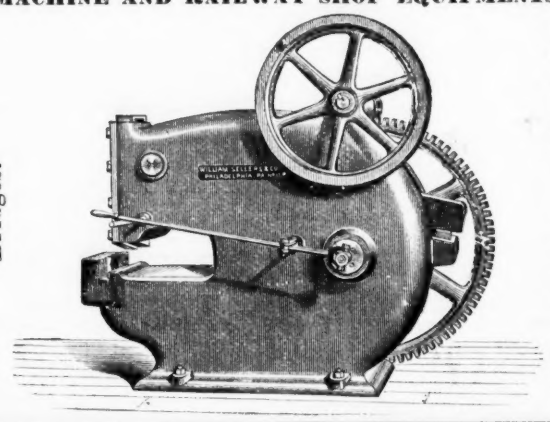

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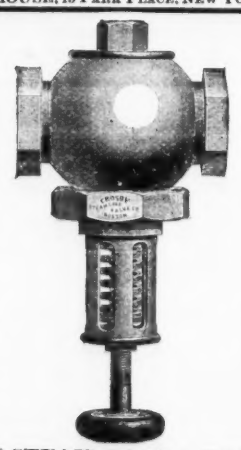

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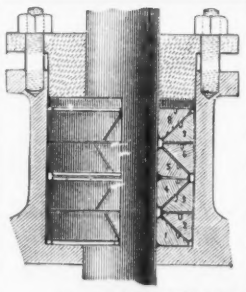

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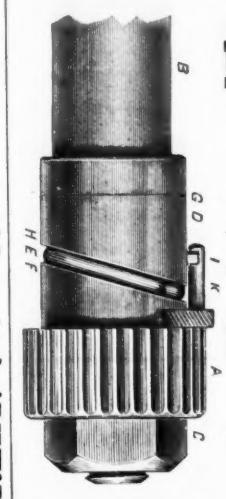

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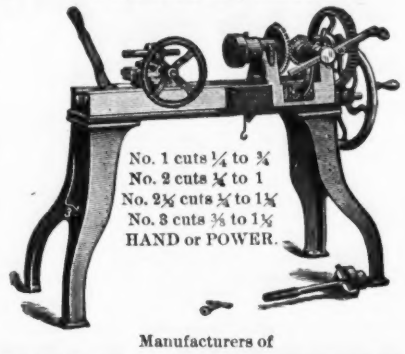

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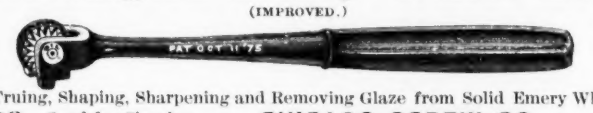

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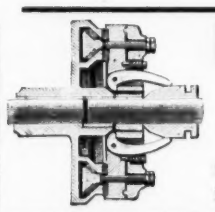

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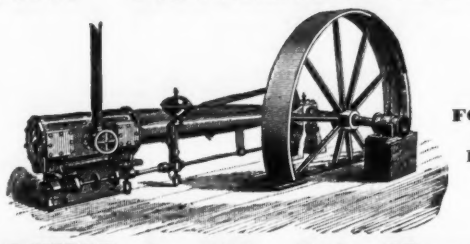

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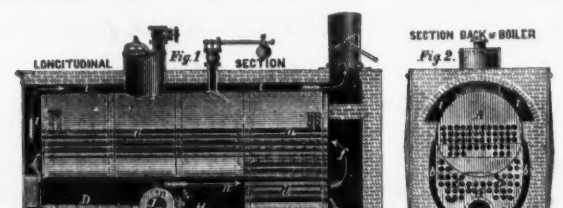

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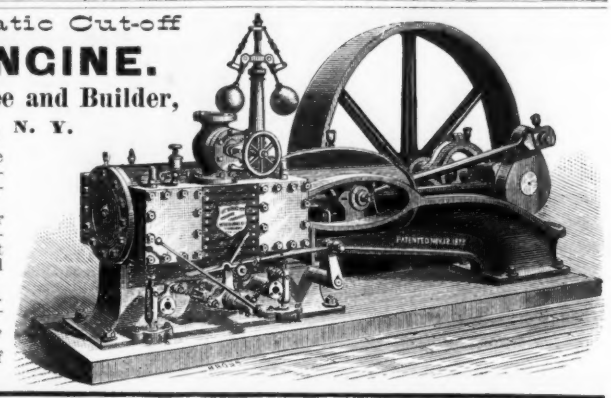

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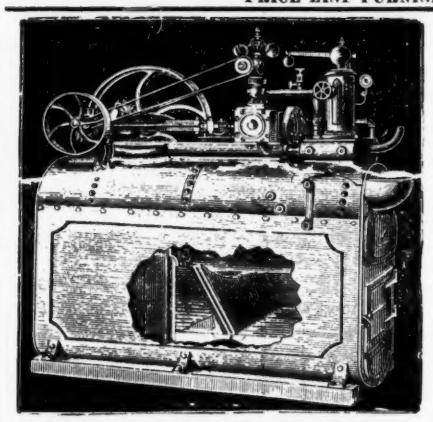

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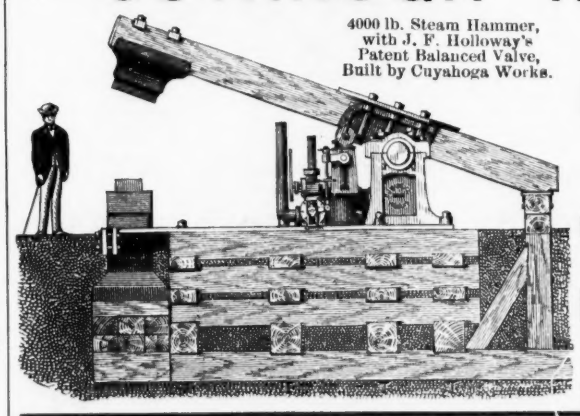

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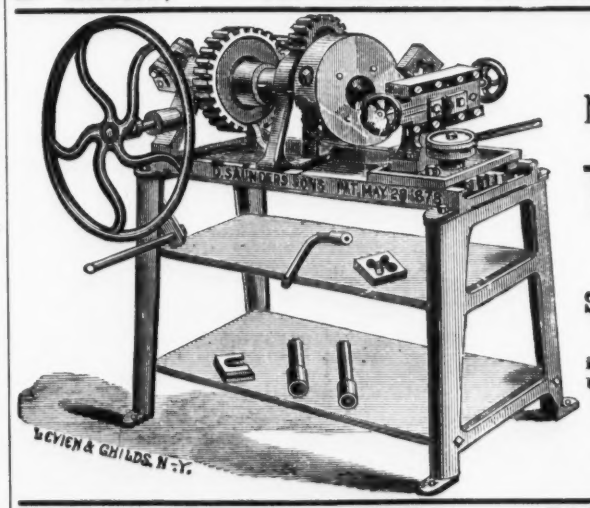

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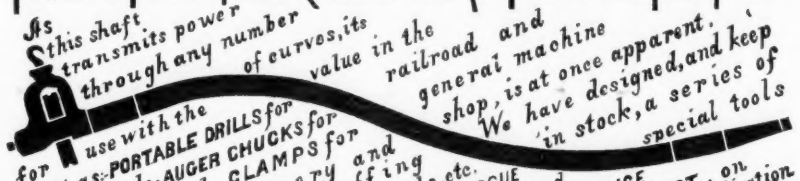
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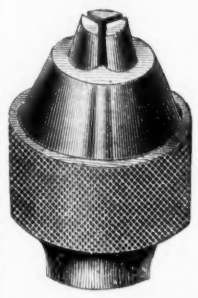

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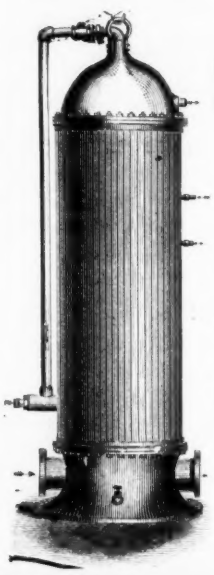

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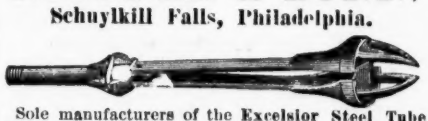

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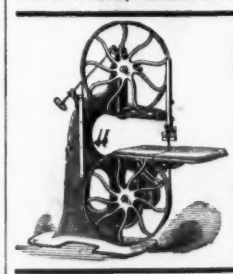

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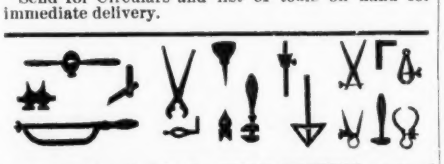

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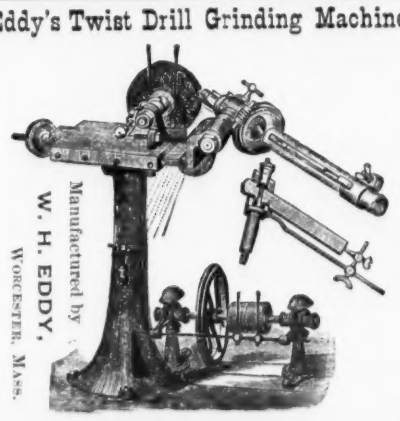

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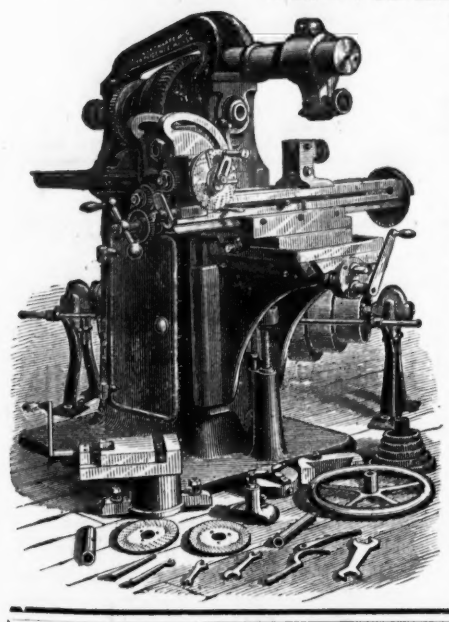

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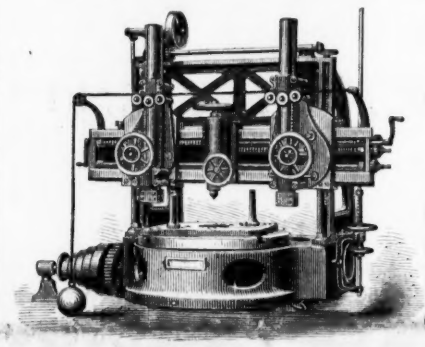

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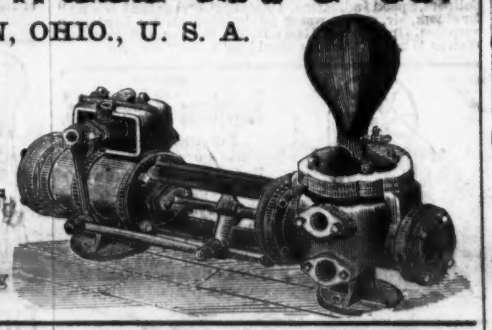

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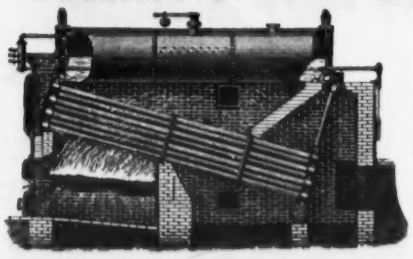

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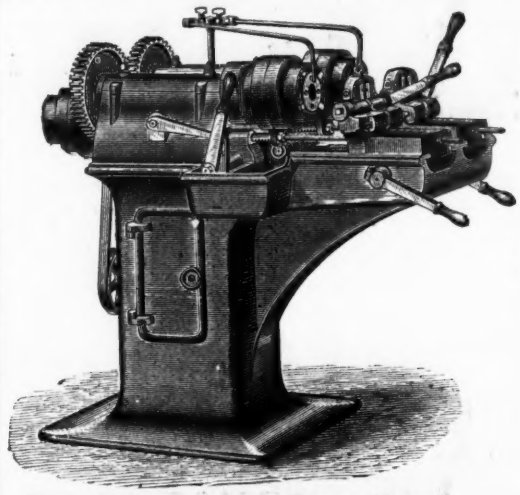

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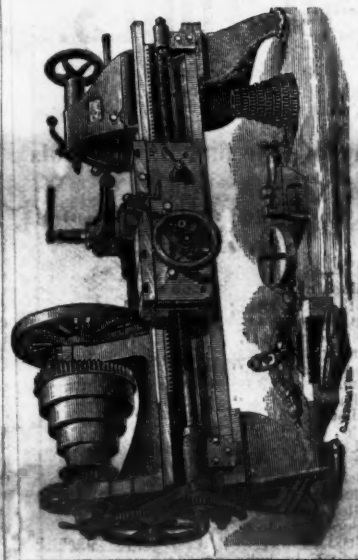

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